FINDING OF NO SIGNIFICANT IMPACT
AND
FINDING OF NO PRACTICABLE ALTERNATIVE

CONSTRUCTION OF AIRFIELD DRAINAGE IMPROVEMENT PROJECTS
MACDILL AIR FORCE BASE, FLORIDA

Agency: United States Air Force (USAF), Headquarters, Air Mobility Command

Background: Pursuant to the President's Council on Environmental Quality (CEQ) regulations, Title 40 Code of Federal Regulations (CFR) Parts 1500-1508, as they implement the requirements of the National Environment Policy Act (NEPA) of 1969, 42 U.S.C. § 4321, et seq., and the Air Force Environmental Impact Analysis Process, as promulgated in 32 CFR Part 989, the USAF conducted an assessment of the potential environmental consequences associated with implementation of the following Proposed Action: Construction of Airfield Drainage Improvement Projects. The attached Environmental Assessment (EA) considered all potential impacts of the proposed action, both as solitary actions and in conjunction with other proposed activities. This Finding of No Significant Impact (FONSI) summarizes the results of the evaluation and the conclusions regarding the significance of impacts from the Proposed Action. The Finding of No Practicable Alternative (FONPA) summarizes the conclusion reached regarding the location of the Proposed Action in a floodplain. The environmental resources areas are discussed in detail in Section 4.0 of the attached EA.

Proposed Action: The Proposed Action is intended to limit the ponding of surface water on the airfield to reduce the potential for bird/aircraft collisions. The projects would involve modification, through either filling or draining low-lying landscape around the airfield, including wetland areas. Impacts to wetland systems have been coordinated with Federal, state and county regulatory agencies. Permits have been secured through the US Army Corps of Engineers (USACE), Southwest Florida Water Management District, and the Environmental Protection Commission (EPC) of Hillsborough County. The Proposed Action is aimed at improving low-lying areas of the airfield where water ponds during the rainy season or during significant rain events. The implementation of the Proposed Action would result in an overall decrease in BASH for aircraft operating at MacDill. This benefit would result in overall positive impacts to the military mission by increasing safety and flight time for aircraft operating from the base both for training and operational activities.

Implementation of the Proposed Action includes depositing approximately 20,000 cubic yards of clean fill material into low-lying areas and wetlands, grading, and maintenance of existing swales and ditches; the replacement of the Rattlesnake Creek culvert and its associated roadway bridge; and the creation of two wetland mitigation areas. In total, the Proposed Action involves grading and/or filling approximately 30.27 acres (1,318,561 square feet) of depression areas or areas with slight topographic irregularities to improve airfield drainage. There are approximately 13.18 acres of total wetland/surface water impacts associates with the Proposed Action, including 3.60 acres of temporary impacts and 9.58 acres of permanent impacts. The wetland/surface water impacts would be offset by the creation of two onsite wetland mitigation areas totaling approximately 10.01 acres. All the wetlands mitigation work would be accomplished on MacDill AFB property.

The Proposed Action includes improvements to Rattlesnake Road culvert. The culvert does not have adequate capacity and has become structurally unsound due to multiple flooding events

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during episodes of heavy rain. As part of the Proposed Action, a new box culvert of adequate capacity is proposed to replace the damaged Rattlesnake Creek culvert. During the construction of the replacement box culvert, flow from the creek would be temporarily diverted. Turbidity barriers would be employed to mitigate any potential adverse effects to water quality. The Proposed Action includes the construction of a new culvert in combination with targeted removal of dense vegetation to restore flow to Rattlesnake Creek. Vegetation proposed for removal includes mangroves and other scrub/shrub vegetation along the banks of Rattlesnake Creek and the immediate vicinity of the temporary diversion canal.

Alternatives: No reasonable alternatives were identified that meet the purpose, need, and selection criterion for the Proposed Action.

Under the No Action Alternative, none of the airfield's drainage improvement projects would be constructed, the BASH incident risk would not be reduced, and the existing airfield drainage inadequacies would remain. If this alternative is implemented, BASH safety concerns would not be addressed, which would adversely affect aircraft operations at MacDill AFB. Under this alternative there would be no improvements to airfield drainage, low-lying areas would not be filled and/or graded, and the seasonal inundation of portions of the airfield during heavy rain events would continue. Furthermore, replacement of the Rattlesnake Road culvert would not be accomplished and the road could eventually become impassible, cutting off access to the runway from the southwestern end. This alternative is not considered to be a viable alternative, as it does not address the BASH safety concerns, or improve airfield drainage deficiencies at MacDill AFB. However, it is included as a basis for comparison, as required under Federal law.

Florida Coastal Zone Management: In accordance with the federal Coastal Zone Management Act (CZMA) and the Florida CZMA, this federal action must be consistent "to the maximum extent practicable" with the Florida Coastal Management Program (CMP). Appendix C to the EA contains the Air Force's Consistency Statement and finds that the conceptual Proposed Action and alternative plans presented in the EA are consistent with Florida's CMP. In accordance with Florida statutes, the Air Force submitted a copy of the attached EA to the State of Florida so that they can perform a coastal zone consistency evaluation. The State of Florida determined that the Proposed Action is consistent with the Florida CMP.

FINDING OF NO SIGNIFICANT IMPACT: Based upon my review of the facts and analyses contained in the attached EA, incorporated by reference, I conclude that implementation of the Proposed Action would not have a significant environmental impact, either by itself or cumulatively with other projects at MacDill AFB. Accordingly, the requirements of NEPA and the regulations promulgated by the Council on Environmental Quality and the Air Force are fulfilled and an Environmental Impact Statement is not required. The *Tampa Tribune* published a Notice of Availability on 25 April 2011. Copies of agency coordination letters, project correspondence, and comments received from the agencies are included in Appendix B of the EA. No public comments were received.

FINDING OF NO PRACTICABLE ALTERNATIVE: Pursuant to Executive Order 11988, the authority delegated in Headquarters Air Force Mission Directive 1-18, and in AMC/CV Redelegation of Environmental Authorities letter , dated 14 January 2005, and taking into consideration the findings of the EA, which is incorporated herein by reference, I find that there is no practicable alternative to the Proposed Action occurring in a floodplain and wetland. The

Proposed Action includes all practicable measures to minimize harm to the environment. Based upon the environmental constraints and the nature of the roadway improvement projects, there are no other available areas located on MacDill AFB that would satisfy the objectives of the Proposed Action. The Proposed Action, as designed, includes all practicable measures to minimize harm to the floodplain. The Air Force has sent all required notices to federal agencies, single points of contact, the State of Florida, local government representatives, and the local news media.

The signing of this combined FONSI/FONPA completes the environmental impact analysis process under US Air Force regulations.

Richard B. Stonestreet

0 2 AUG 2011

RICHARD B. STONESTREET, Colonel, USAF
Deputy Director of Installations and Mission Support

DATE

Attachment:
EA

Environmental Assessment

for

Construction of Airfield Drainage Improvement Projects

MacDill AFB, Florida

Headquarters Air Mobility Command

Scott AFB, IL

June 2011

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SECTION 1.0
PURPOSE OF AND NEED FOR PROPOSED ACTION

This Environmental Assessment (EA) examines the potential for impacts to the environment resulting from the implementation of Airfield Drainage Improvement Project at MacDill Air Force Base (AFB) (the Proposed Action).

Principally, the Proposed Action seeks to eliminate depression areas on the airfield where stormwater frequently pools. Areas of ponding on the airfield attract wildlife, especially birds, which increases the potential for bird aircraft strikes. Eliminating depression areas on the airfield would reduce the potential for bird aircraft strikes, thereby improving airfield safety, decreasing mission down time, and reducing aircraft maintenance and repair costs. These goals would be accomplished through restoring certain deficiencies in the airfield drainage system. The Airfield Drainage Improvement Projects include the following types of construction activities: draining areas where storm water ponds, regrading existing drainage swales and ditches, regrading slight topographic irregularities, filling and grading depression areas, replacing a substandard culvert, restoring associated ditch banks and creating two wetland mitigation areas. This EA addresses the environmental effects associated with the implementation of the Proposed Action at MacDill AFB, as well as the No Action Alternative. No other practicable alternatives were identified that meet the purpose and need and selection criterion for the Proposed Action.

1.1 MISSION

First established in 1939 as an Army airfield, MacDill AFB became an Air Force Base in 1948. The Base has undergone several mission changes and played a vital role in training and strategic defense. Since 1996, MacDill AFB has been host to the 43rd Aerial Refueling Group (ARG) which joined the 6th Air Base Wing to form the 6th Air Refueling Wing (6 ARW). With the addition of the Commander in Chief (CINC) Support mission in January 2001, the 6th ARW was redesignated the 6th Air Mobility Wing (6 AMW). The 6 AMW is the host unit at MacDill AFB and reports to Air Mobility Command (AMC), headquartered at Scott AFB, Illinois. The 6th Air Mobility Wing's overall mission is to Generate and Execute Air Refueling Airlift, and Contingency Response Capabilities while providing Base Support for Joint, Coalition and

Interagency Partners including Headquarters US Central Command (USCENTCOM) and Headquarters US Special Operations Command (USSOCOM), and 38 other mission partners that call MacDill AFB home (http://www.macdill.af.mil/units/index.asp).

In addition, the Base provides similar support to tenant agencies and the MacDill community, including over 116,000 retirees and their families (http://www.tampa.va.gov/about/index.asp). The organizational structure of 6 AMW consists primarily of a maintenance group, medical group, operations group, and mission support group.

1.2 PURPOSE OF AND NEED FOR PROPOSED ACTION

The purpose of the Proposed Action is to eliminate areas of standing water on the airfield.. Improving airfield drainage would reduce wildlife on the airfield and meet a crucial need to decrease the potential for bird aircraft strikes. Aircraft/bird collisions are a potential hazard at airports worldwide. Due to its proximity to Tampa Bay and extensive undeveloped shoreline along the perimeter of the Base, MacDill AFB faces an elevated risk of such collisions on a daily basis. In an attempt to reduce the risk and the number of these incidents, the Proposed Action seeks to reduce potential food sources, and foraging areas for birds and other wildlife by correcting existing deficiencies within the drainage system on the airfield. Addressing the existing deficiencies within the drainage system on the airfield is the most permanent method for discouraging wildlife from using the airfield. Replacement of a drainage system culvert at Rattlesnake Road is also included in the Proposed Action due to its close proximity to the airfield and similar environmental setting.

The airfield is the heart of the military mission at MacDill AFB. Originally constructed in the 1940's, the runway and taxiways of the MacDill airfield have been modified and extended over the years. Construction and repair activities around the airfield, particularly in the vicinity of the runway, have resulted in changes to both the surface cover and the contour of the land surface, leading to unintended changes to the drainage system. Maintenance activities, such as mowing, have formed linear depressions where tractors have created ruts over time through lower lying areas. Additionally, the topography of the airfield area has been changed, even if slightly, over the last 60 years through natural settling of the land, erosion and runoff. Together, these events have resulted in the formation of low lying areas where rainwater is trapped and cannot run off.

During moderate to severe rain events or during excessively rainy periods, water often ponds in the low lying areas around the runway. The ponded water typically attracts wildlife, particularly birds, which like to forage in the temporary pools. The presence of birds particularly in large numbers, are a threat to the operation of aircraft at MacDill AFB and can hinder the military mission. MacDill AFB needs to correct airfield drainage deficiencies to eliminate areas of standing water that attract wildlife and increase the potential for bird aircraft strikes. The implementation of the Proposed Action would meet the need of reducing the bird-aircraft strike hazard (BASH) by eliminating bird shelter areas, food sources, and foraging areas through improved drainage around the airfield.

Implementation of the airfield drainage improvements would result in a loss of wetlands along the runway, resulting in the need to complete mitigation at another area within the Base as part of the Proposed Action.

1.3 LOCATION OF PROPOSED ACTION

The Proposed Action would take place at MacDill AFB, located in Tampa, Florida. The Base occupies approximately 5,630 acres and is in Hillsborough County, adjacent to the City of Tampa, at the southern tip of the Interbay Peninsula. The installation elevation ranges from sea level to approximately 15 feet above mean sea level (MSL). Much of the Base is less than five feet above MSL, and wetland areas are common, especially mangrove wetlands. The Base is surrounded on three sides by Tampa Bay and Hillsborough Bay, and is bordered on the north by development within the City of Tampa. Land uses adjacent to the Base are a mix of single-family residential, light commercial and industrial designations. **Figure 1-1** is the location map of MacDill AFB. The proposed locations of the Airfield Drainage Improvement Projects are located on the airfield, in the western portion of MacDill AFB.

Figure 1-2 is the specific location map for the proposed Airfield Drainage Improvement Project, Rattlesnake Road culvert repair/replacement, and associated wetland mitigation areas at MacDill AFB.

Figure 1-1 – MacDill AFB is located at the tip of the Interbay Peninsula in Tampa Bay. The general location of the Proposed Action is presented in the red box.

Figure 1-2 – Location of the Airfield Drainage Repair Project and Mitigation Areas on MacDill AFB

1.4 THE SCOPE OF THE ENVIRONMENTAL REVIEW

To initiate this environmental analysis, the 6th Civil Engineer Squadron Plans Programs and Production Flight (6 CES/CEP) submitted an Air Force (AF) Form 813, Request for Environmental Impact Analysis, to the 6th Civil Engineer Environmental Flight (6 CES/CEV) (**Appendix A**). 6 CES/CEV determined the Proposed Action did not qualify for a categorical exclusion; therefore, an EA is required. This EA identifies, describes, and evaluates potential environmental impacts associated with the proposed Airfield Drainage Improvement Projects at MacDill AFB (the Proposed Action), as well as the No Action Alternative. This section discusses the issues evaluated during the environmental impact analysis process.

1.4.1 Issues Eliminated from Further Analysis

Based on the scope of the Proposed Action, and the No Action Alternative, as well as preliminary analyses, the Air Force eliminated the issues detailed below from further analysis.

1.4.1.1 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 requires that Federal agencies analyze the impacts of Federally directed or funded undertakings on historic properties. According to the MacDill AFB Integrated Cultural Resources Management Plan (ICRMP), dated September 2006, (USAF, 2006a) no significant cultural resources, including archeological sites or historic structures, are located in the vicinity of the Proposed Action. The cultural resource Site 8Hi3382, also identified as "Runway Site" in the ICRMP, is located within the airfield. However, the closest airfield drainage improvement project would be located approximately 1,950 feet southwest of cultural resource Site 8Hi3382 (**Figure 1-2**). In accordance with Section 106 of the National Historic Preservation Act, consultation with the State Historic Preservation Office (SHPO) has been accomplished to confirm that historic resources would not be impacted by the Proposed Action **(Appendix B)**. Consequently, the Air Force excluded cultural resources from any further analysis.

If any work not included as part of the Proposed Action put forward in this EA is required in the future, these plans must be coordinated with 6 CES/CEV prior to their approval and implementation. Should a cultural resource discovery be made during the implementation of the

Proposed Action, operation will immediately cease while a determination of finding is completed.

1.4.1.2 Land Use

MacDill AFB designates land use as one of the following: airfield, urban, industrial, light industrial, commercial, institutional (educational & medical), residential, recreational, or improved vacant land. The Proposed Action sites are designated as airfield use areas. The Proposed Action would not alter land use at any of the proposed Airfield Drainage Improvement Projects sites. Consequently, the Air Force did not conduct further analysis for potential land use impacts.

1.4.1.3 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, assures that Federal agencies focus attention on the potential for a proposed Federal action to cause disproportionately high and adverse health effects on minority populations or low-income populations. Preliminary review revealed that no environmental justice areas of low-income and/or minority populations were located immediately adjacent to the Proposed Action sites. The Airfield Drainage Improvement Projects sites are located along the airfield runway corridor on military property. The closest off-base residential areas are approximately one quarter-mile from the nearest part of the Proposed Action.

As described in the Installation Development Environmental Assessment for MacDill AFB, the 2000 Census evaluated the 12 census tracts located adjacent to the base fence line. Tracts 70 and 72, adjacent to the northwestern boundary of the base, were identified as having the highest ethnic populations (24.2% and 28.6% respectively) and the lowest per capita incomes of the 12 tracts evaluated.

To ensure compliance with EO 12898, the USAF examined and compared the ethnicity and poverty status in areas adjacent to the base to the regional and state statistics to determine if the Proposed Action would disproportionately affect minority or low-income groups. The environment around MacDill AFB is influenced by United States Air Force (USAF) operations,

land management practices, vehicular traffic, and emissions sources outside the base. The construction projects in the Proposed Action would be performed by outside contractors, typically with employees living within the region of influence (ROI) and Tampa-St. Petersburg metropolitan area. The USAF did not identify any disproportionate impacts on minority or low-income populations from the Proposed Action.

In addition, EO 13045 requires that Federal agencies identify and assess environmental health and safety risks that might disproportionately affect children. The Proposed Action would not pose any adverse or disproportionate environmental health or safety risks to children living near the base. The likelihood of the presence of children near the Proposed Action would be minimal. No significant adverse effects on minority populations, low-income populations or children would be expected. Consequently, the Air Force excluded environmental justice from any further evaluation.

1.4.1.4 Socioeconomics

The Economic Impact Region (EIR) for MacDill AFB is the geographic area within a 50-mile radius of the base subject to significant base-related economic impacts. According to the 2002 Economic Resource Impact Statement for MacDill AFB (USAF, 2003), the total economic impact of MacDill AFB on the EIR was $5.59 billion with over 133,000 jobs supported. Retiree income provides an economic impact of $2.13 billion. The direct impact on local income produced by base expenditures is $1.2 billion.

The Proposed Action would cost approximately $3,100,000 to implement, based on 2010 AF cost estimates. In total this would equal less than 1 percent of the nearly $1.2 billion annual expenditures that MacDill AFB provides to the local economy, and would therefore constitute a relatively inconsequential short-term beneficial impact on the work force in the region during the construction period. No significant adverse effects would be expected. Consequently, the Air Force excluded socioeconomics from any further evaluation.

1.4.1.5 Transportation

MacDill AFB is served by four operating gates on the north side of the base: Dale Mabry Highway, Bayshore Boulevard, MacDill Avenue, and Tanker Way gates. The Dale Mabry,

Bayshore, and MacDill gates are used for government and personal vehicles. The Tanker Way gate is used as the large vehicle (contractor trucks, delivery vehicles, and recreational vehicles) entry point. Large vehicles are inspected, and their credentials and destinations are confirmed before entering the base.

During the implementation of the Proposed Action construction vehicles will access the airfield via Tanker Way gate. Commuter traffic flow on base would remain unchanged along the arterials, collectors, and local streets that connect with the off-base network through the remaining three gates during the Proposed Action. Consequently, the Air Force excluded transportation from any further evaluation.

1.4.1.6 Hazardous Materials, Wastes and Stored Fuels

Hazardous Materials, Wastes and Stored Fuels issues are associated with the use of hazardous materials or the generation of hazardous waste during construction projects. This resource area also includes the potential for encountering or affecting hazardous waste cleanup (Environmental Restoration Program (ERP)) sites during construction. No hazardous materials would be used during filling and grading activities and no hazardous waste would be generated. Implementation of the Proposed Action, would not generate waste with the exception of minor municipal waste recycling as a result of replacing a box culvert along Rattlesnake Road. Stored fuel issues typically involve the storage or transfer of substantial volumes of fuel, neither of which is involved with the Proposed Action. Furthermore, there are no hazardous waste clean-up sites in the vicinity of the Proposed Action. Consequently, the Air Force did not conduct further analysis for potential wastes, hazardous materials, wastes and stored fuel impacts.

1.4.1.7 Asbestos and Lead-Based Paint

The Proposed Action does not involve the demolition of facilities containing asbestos or lead-based paint. Therefore, the Air Force excluded asbestos or lead-based paint from any further evaluation.

1.4.2 Issues Studied in Detail

Preliminary analysis based on the scope of the Proposed Action and the No Action Alternative identified the following potential environmental issues warranting detailed analysis: noise; air

quality; water resources; floodplains; biological resources; airspace/airfield operations and BASH; safety and occupational health; and geology and soils.

1.5 APPLICABLE REGULATORY REQUIREMENTS

This environmental analysis has been conducted in accordance with the President's Council on Environmental Quality (CEQ) regulations, Title 40 of the Code of Federal Regulations (CFR) §§1500-1508, as they implement the requirements of the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §4321, et seq., and Air Force Instruction (AFI) 32-7061 Environmental Impact Analysis Process, as promulgated in 32 CFR Part 989. These regulations require Federal agencies to analyze the potential environmental impacts of proposed actions and alternatives and to use these analyses in making decisions on a proposed action. Cumulative effects of other ongoing activities also must be assessed in combination with the Proposed Action. The CEQ was instituted to oversee Federal policy in this process. The CEQ regulations declare that an EA is required to accomplish the following objectives:

- Briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI);
- Aid in an agency's compliance with NEPA when an EIS is not necessary, and facilitate preparation of an EIS when necessary.

32 CFR 989 specifies the procedural requirements for the implementation of NEPA and preparation of the EA for the U.S Air Force.

Other environmental regulatory requirements relevant to the Proposed Action are also identified in this EA. Regulatory requirements under the following programs were assessed: Noise Control Act of 1972; Clean Air Act; Clean Water Act; National Historic Preservation Act; Endangered Species Act; Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA) of 1970; and Occupational Safety and Health Act. Requirements also include compliance with Executive Order (EO) 11988, Floodplain Management; EO 11990, Protection of Wetlands; Federal Coastal Zone Management Act; and EO 12898 and EO 13045 Environmental Justice.

1.6 COASTAL ZONE CONSISTENCY DETERMINATION

The Federal Coastal Zone Management Act (CZMA) creates a state-Federal partnership to ensure the protection of coastal resources. The Federal CZMA requires each Federal agency activity within or outside the coastal zone which affects any land or water use or natural resources of the coastal zone to be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of the Florida Coastal Management Program (CMP) of 1981. The Florida CZMA presumes that “direct Federal activities” will directly affect the coastal zone. According to the Florida CMP, “direct Federal activities” are those that “are conducted or supported by or on behalf of a Federal agency in the exercise of its statutory responsibilities, including development projects.”

The Federal CZMA requires Federal agencies carrying out activities subject to the Act to provide a “consistency determination” to the relevant state agency. The Federal regulations implementing the Act then require the state agency to inform the Federal agency of its agreement or disagreement with the Federal agency’s consistency determination. Therefore, the Proposed Action analyzed in this EA requires a consistency determination to be submitted by the U.S. Air Force to the relevant Florida agency and a response from the State of Florida of either agreement or disagreement with that determination. The Air Force’s Consistency Determination is contained in the Consistency Statement at **Appendix C**. This EA including the Air Force’s Consistency Statement was submitted to Florida State Clearinghouse for a multi-agency review. The Florida Department of Community Affairs assembled and reviewed the comments provided by the various state and county agencies and determined that the proposed project is consistent with the Florida Coastal Management Program. Public notice and multi-agency coordination correspondence is included in **Appendix B**.

SECTION 2.0
DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 THE PROPOSED ACTION AND ALTERNATIVES

This section provides a detailed description of the Proposed Action. The Proposed Action involves the implementation of the Airfield Drainage Improvement Project.

2.1.1 Description of the Proposed Action

During moderate to severe rain events or during excessively rainy periods, storm water often ponds in the low lying areas on the airfield. These areas typically attract wildlife, particularly birds, which like to forage for food in the temporary pools.

The Proposed Action would correct existing deficiencies with the drainage system around the runway by filling with the addition of soil and subsequent grading of low-lying areas. The Proposed Action seeks to minimize bird shelter areas, food sources, and foraging areas around the airfield. The Proposed Action would accomplish this through restoration of the airfield drainage system by the completion of multiple repair activities. The Proposed Action also includes demolition and replacement of the Rattlesnake Road box culvert and the creation of two wetland mitigation areas.

2.1.2 Description of the No Action Alternative

Another alternative to the Proposed Action is the No Action Alternative. Under the No Action Alternative, no airfield drainage improvements would be constructed.

2.2 SELECTION CRITERIA

2.2.1 Selection Criteria Process

Prior to the implementation of a given action, a listing of certain criteria the action should meet is developed. The following sections describe the Proposed Action and the No Action Alternative in detail, how these options were developed, the criterion the Proposed Action should meet, and the basis for selection of the Proposed Action.

The following sections specifically include:

- A list of the environmental constraints and other selection criteria that influence the location of the Proposed Action;
- A detailed description of the Proposed Action;
- A description of the alternative considered for implementation of the Proposed Action; and
- A matrix comparing the environmental effects of the Proposed Action and No Action Alternative.

2.2.2 Selection Criteria Details

Over the last 60 years maintenance and repair activities around the airfield, particularly in the vicinity of the runway, have formed linear depressions, leading to unintended changes to the airfield drainage system. The selection criteria for addressing these issues was first and foremost to reduce the potential for bird aircraft strike incidents. Associated selection criterion are 1) the action should help repair and restore the airfield drainage systems, 2) should minimize bird shelter areas, food sources, and foraging areas around the airfield, and 3) should minimize the destruction, loss or degradation of wetlands.

Although the Proposed Action would result in temporary and permanent wetlands impacts, a net gain of wetlands would be created at an alternate location on Base to mitigate impacts to wetlands as a result of the Proposed Action. The appropriate Federal, state, and county regulatory agencies have reviewed the proposed wetland impacts associated with the Proposed Action and have verified that the designed mitigation project is sufficient to offset the anticipated adverse impacts to wetland systems. The Proposed Action as designed would result in the net positive generation of wetlands acreage.

The Proposed Action meets the selection criterion. The No Action Alternative involves no reduction of bird aircraft strike risks, nor does it complete any restoration or repair to drainage systems on the airfield; and, therefore, does not meet the selection criterion. The No Action alternative would allow the presence of low-lying areas where water ponds during the rainy season or significant rain events to remain. The presence of shallow water around the runway

would continue to attract birds, which would result in a continued BASH for aircraft operating at MacDill AFB.

2.3 DETAILED DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action is intended to limit the ponding of surface water on the airfield to reduce the potential for bird/aircraft collisions. The projects would involve modification, through either filling or draining low-lying landscape around the airfield, including wetland areas. Impacts to wetland systems have been coordinated with Federal, state and county regulatory agencies. Permits have been secured through the US Army Corps of Engineers (USACE), Southwest Florida Water Management District (SWFWMD), and the Environmental Protection Commission (EPC) of Hillsborough County. The Proposed Action is aimed at improving low lying areas of the airfield where water ponds during the rainy season or during significant rain events. The implementation of the Proposed Action would result in an overall decrease in BASH for aircraft operating at MacDill. This benefit would result in overall positive impacts to the military mission by increasing safety and flight time for aircraft operating from the base both for training and operational activities. The Airfield Drainage Improvement Projects are being designed in FY11 and planned for implementation in FY12.

Implementation of the Proposed Action includes depositing fill material into low-lying areas and wetlands, grading, and maintenance of existing swales and ditches; the replacement of the Rattlesnake Creek culvert and its associated roadway bridge; and the creation of two wetland mitigation areas. In total, the Proposed Action involves grading and/or filling approximately 30.27 acres (1,318,561 square feet) of depression areas or areas with slight topographic irregularities to improve airfield drainage. The types of impacts to wetlands that will occur as a result of the Proposed Action include temporary and permanent impacts. Temporary impacts will not permanently alter the hydrologic function of the wetland system being altered. There are approximately 13.18 acres of total wetland/surface water impacts associates with the Proposed Action including 3.60 acres of temporary impacts and 9.58 acres of permanent impacts.

Permanent wetland impacts are typically identified as any disturbance that affects the existing wetland soils. This disturbance can include placement of fill material within the wetland or excavation of existing wetland soils. Both disturbance types ultimately result in a loss of

wetland area and function. Temporary impacts to wetlands occur when it is necessary to disturb vegetation to complete construction activities or in the case of the Proposed Action, filling activities. Temporary impacts would be restored after completion of the filling activities as in-kind wetland restoration.

The wetland/surface water impacts would be offset by the creation of two onsite wetland mitigation areas totaling approximately 10.01 acres. Mitigation is expected to offset adverse impacts to wetlands caused by the Proposed Action and to achieve viable, sustainable ecological and hydrological wetland functions. All of the wetlands mitigation work would be accomplished on MacDill AFB property. Proposed creation measures include the installation of wetland species composed of mixed scrub and herbaceous plantings. The approximate locations of the proposed mitigation areas and a preferred alternative location for the mitigation area located are shown on **Figure 1-2**. The wetland mitigation areas would be planted and monitored for five years in accordance with the mitigation permit plan. In that time the mitigation areas would be expected to develop into freshwater or saltwater marsh as directed by the mitigation permits. Topography, water depth, water level fluctuation and planted or recruited herbaceous/scrub species would be expected to exhibit characteristics of a freshwater or saltwater marsh, depending on location. Coverage by nuisance or exotic species would not be expected to exceed five percent at any location within the mitigation sites. Maintenance of the wetland mitigation sites would include the manual removal of all nuisance or exotic species, with sufficient frequency that their combined coverage at no time exceeds five percent at any location.

While mitigation areas are currently planned for use to offset the impacts of the Proposed Action, permit requirements may necessitate adding or changing the locations of the mitigation areas. In either case, the wetland mitigation projects would be implemented before or concurrent with implementation of the Airfield Drainage Improvement Projects. The impacts and implementation of wetlands created in the preferred alternate location would be similar to those encountered at the proposed mitigation areas with the exception of explosive safety issues and are discussed further in **Section 4.7.1.2**.

Approximately 20,000 cubic yards of clean fill is proposed to be placed within the jurisdictional wetland or surface water areas associated with the Proposed Action. A combination of clean fill

from on-base stockpiles and off-base sources is proposed to raise the ground elevation, eliminating seasonal inundation of certain areas on the airfield.

The Proposed Action includes improvements to Rattlesnake Road culvert. The replacement of the Rattlesnake Creek culvert is included in the Proposed Action due to the close proximity and similar environmental setting to the airfield. As part of the Proposed Action, a new box culvert of adequate capacity is proposed to replace the damaged Rattlesnake Creek culvert. Presently, the Rattlesnake Creek culvert does not have adequate capacity to handle water flow during heavy rain events and has become structurally unsound due to multiple flooding events. The headwalls are damaged and have separated from the drainage pipes. Additionally, the drainage pipes underlying the road are cracked resulting in the loss of roadbed material through the cracks leading to the formation of holes and uneven settlement in the road. As a result of the damaged culvert, Rattlesnake Road may eventually become impassable.

During the construction of the replacement box culvert, flow from the creek would be temporarily diverted. Turbidity barriers would be employed to mitigate any potential adverse effects to water quality. The Proposed Action includes the construction of a new culvert in combination with targeted removal of dense vegetation to restore flow to Rattlesnake Creek. Vegetation proposed for removal includes mangroves and other scrub/shrub vegetation along the banks of Rattlesnake Creek and the immediate vicinity of the temporary diversion canal.

The Proposed Action would include provisions for disturbed areas of the airfield due to construction and filling activities. Routine airfield sweeper vehicle patrols used to remove foreign object debris (FOD) would be increased to reduce the potential adverse impacts of fugitive construction debris associated with the implementation of the Proposed Action. Safety precautions routinely employed during construction activities, such as dust suppression and personal protective equipment, would be applied during implementation of this project to ensure that the Proposed Action does not pose any adverse health or safety risks to airfield personnel, construction workers or aircraft.

Photographs of the proposed Airfield Drainage Improvement Project areas are included in **Appendix D**.

2.4 ALTERNATIVES ELIMINATED FROM FURTHER EVALUATION

An Alternative to the Proposed Action was initially considered but was eliminated from further evaluation. This alternative included an increase in BASH control techniques currently used at MacDill AFB in lieu of implementation of the Proposed Action. BASH control techniques involve effecting wildlife to disperse birds from the airfield to give short-term relief from an immediate safety hazard. BASH control techniques require a combination of different dispersal tools, known as Integrated Pest Management, that may include but are not limited to: pyrotechnics, bioacoustics, harassment using dogs and depredation. A depredation permit is not required for non-lethal harassment of migratory birds on the airfield IAW 50 CFR 21.41 *Migratory Bird Depredation Permits*. MacDill AFB was issued a Federal depredation permit issued through the U.S. Fish and Wildlife Service (USFWS), which authorizes the take of migratory birds species to relieve or prevent injurious situations affecting public safety. The permit authorized the take of 'minimum numbers and species' of birds.

MacDill AFB currently utilizes the above-mentioned control techniques in the Bird Strike Control Program. Additional use of these techniques would not eliminate attempts by birds to land, forage, and/or attempt to nest on the airfield. Bird take-offs and landings are the highest potential time for strikes with aircraft. Therefore, this alternative does not meet the selection criterion, as the desirable habitat for birds would remain. This alternative does not significantly reduce BASH over the long-term. In addition, it does nothing to help repair and restore the airfield drainage systems, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values served by floodplains. Therefore, this alternative of increased BASH control techniques around the airfield was eliminated from further evaluation, as it did not meet the selection criteria.

An alternative to the Rattlesnake Road culvert replacement was initially considered but was eliminated from further evaluation. This alternative included constructing a bridge over the existing culvert without removing it. This alternative would eliminate the wetlands impact; however, the culvert is nearing failure and collapse. Additionally, the existing culvert is not adequately sized to handle the water flow. Once the culvert fails, it will block or severely limit the flow of water, which would increase the potential for upstream flooding on MacDill AFB.

No other practicable alternatives were identified that meet the purpose and need and selection criterion for the Proposed Action.

2.5 DESCRIPTION OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, none of the Airfields drainage improvement projects would be constructed, the BASH incident risk would not be reduced, and the existing airfield drainage inadequacies would remain. If this alternative is implemented, BASH safety concerns would not be addressed, which would adversely affect aircraft operations at MacDill AFB. Under this alternative there would be no improvements to airfield drainage, low-lying areas would not be filled and/or graded, and the seasonal inundation of portions of the airfield during heavy rain events would continue. Furthermore, replacement of the Rattlesnake Road culvert would not be accomplished and the road could eventually become impassible, cutting off access to the runway from the southwestern end.

This alternative is not considered to be a viable alternative, as it does not address the BASH safety concerns, or improve airfield drainage deficiencies at MacDill AFB. However, it is included as a basis for comparison, as required under Federal law.

2.6 OTHER ACTIVITIES IN THE AREA

Routine maintenance and repair projects are an on-going occurrence at MacDill AFB. There are no other construction projects proposed for areas adjacent to the airfield.

SECTION 3.0
AFFECTED ENVIRONMENT

This section establishes the basis and methodology for assessing impacts to resource areas that could be affected by the Proposed Action and No Action Alternative.

The area has a humid, subtropical climate characterized by long, hot summers and short, mild winters. The average annual temperature is approximately 73 degrees Fahrenheit (°F) with average minimum and maximum temperatures being approximately 63°F and 82°F, respectively. The rainy season generally occurs from May through September, with the dry season occurring during late fall and winter. Annual rainfall averages approximately 44.77 inches, according to the Intellicast website, (http://www.intellicast.com/Local/History.aspx?location=USFL0481).

The Base has an active runway (04-22) and an inactive runway that is used as a taxiway. MacDill AFB airfield facilities provide the capability to accommodate any aircraft in service with the United States government. The Base contains more than 520 buildings, including administrative and support facilities, a medical and dental clinic, military housing, and recreation areas.

There are a number of land use, regulatory, and mission-related constraints within the boundaries of MacDill AFB that influence and limit development at the installation. The constraints include the following: Airfield Infrastructure, Clear Zones, and Imaginary Surfaces; Wetlands; Coastal Zone Management Act; Threatened and Endangered Species and Associated Habitats; Cultural Resources, Historic Buildings, and Archaeological Sites; Environmental Restoration Program (ERP) Sites; Quantity Distance (QD) arcs; and 100-Year Floodplain. **Figure 3-1** depicts the MacDill AFB constraints.

Figure 3-1 –MacDill AFB Environmental Constrains Map

3.1 NOISE

The primary human response to environmental noise is annoyance (American Industrial Hygiene Association, 1986). The degree of annoyance has been found to correlate well with the day-night average sound level (DNL). Annoyance for short-term activities, such as construction noise and fire fighting, could be influenced by other factors such as awareness and attitude toward the activity creating the noise.

Several social surveys have been conducted in which people's reaction to their noise environment has been determined as a function of DNL occurring outside their homes. Guidelines have been developed for individual land uses based upon the information collected in these surveys and upon information concerning activity interference. For various land uses, the level of acceptability of the noise environment is dependent upon the activity that is conducted and the level of annoyance, hearing loss, speech interference, and sleep interference that results there from.

In June 1980, the Federal Interagency Committee on Urban Noise published guidelines (FICUN 1980) relating DNL values to compatible land uses. This committee was composed of representatives from the U.S. Departments of Defense, Transportation, and Housing and Urban Development; the USEPA; and the Veterans Administration. Since their issuance, Federal agencies have generally adopted their guidelines for noise analysis. Most agencies have identified 65 decibels (dB) DNL as a criterion that protects those most affected by noise and that can often be achieved on a practical basis. Base activities that have the highest potential source of noise impacts are the aircraft/airspace operations. The Air Installation Compatible Use Zone (AICUZ) Study (2008) plotted the DNL from 65 to 80 dB for a representative day at MacDill (**Figure 3-2**). The DNL contours reflect the aircraft operations at MacDill AFB. The DNL 65 dB contour covers the main runway, and extends about one mile southwest over Tampa Bay, and about 1½ miles northeast over Hillsborough Bay.

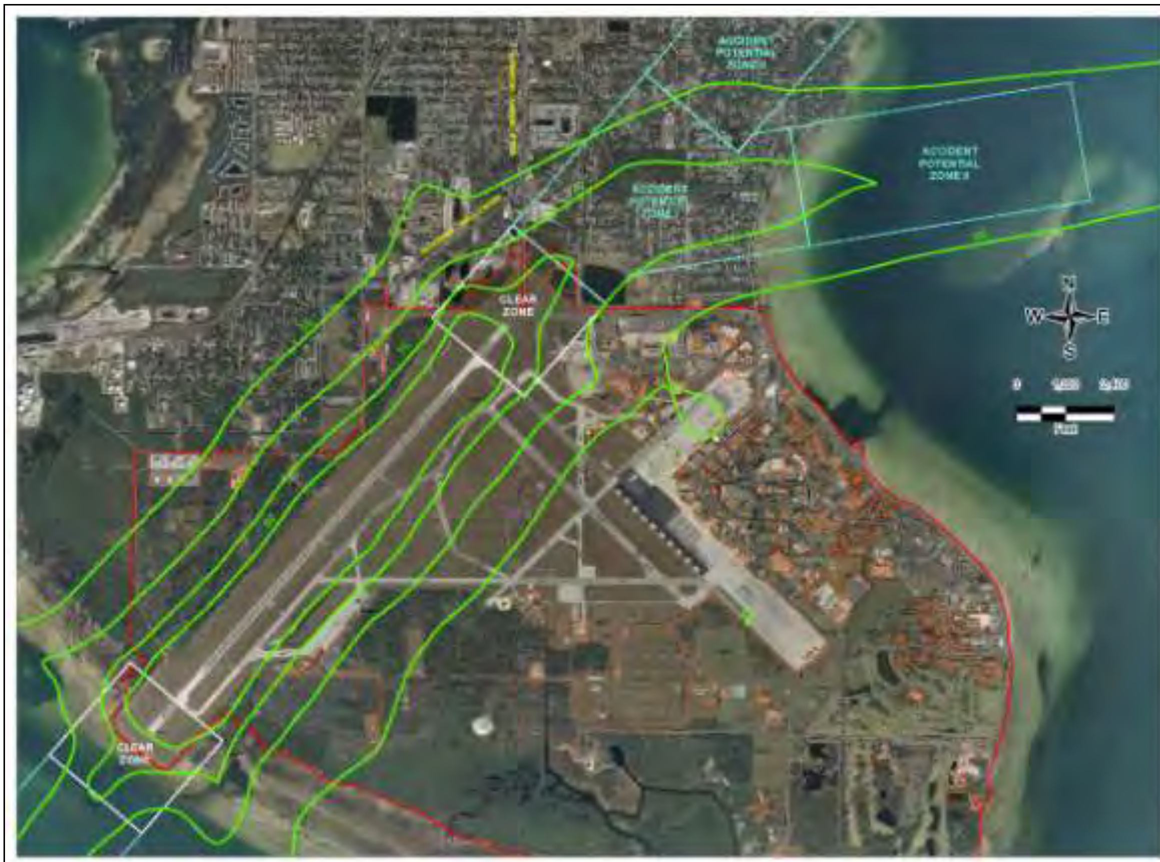

Figure 3-2 – Noise Contours for a Representative Day at MacDill AFB

3.2 AIR QUALITY

3.2.1 Air Pollutants and Regulations

The Clean Air Act (CAA) of 1970 directed the U. S. Environmental Protection Agency (USEPA) to develop, implement, and enforce strong environmental regulations that would ensure cleaner air for all Americans. In order to protect public health and welfare, the USEPA developed concentration-based standards called National Ambient Air Quality Standards (NAAQS). The USEPA established both primary and secondary NAAQS under the provisions of the CAA. Primary standards define levels of air quality necessary to protect public health with an adequate margin of safety. Secondary standards define air quality levels necessary to protect public welfare (i.e., soils, vegetation, property, and wildlife) from any known or anticipated adverse effects. NAAQS currently are established for six air pollutants (known as criteria air pollutants) including carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), sulfur oxides (SO_x), measured as sulfur dioxide [SO_2]), lead (Pb), and particulate matter. Particulate matter standards incorporate two particulate classes: (1) particulate matter with an aerodynamic diameter less than or equal to 10 micrometers [PM_{10}]; and (2) particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers [$PM_{2.5}$].

The CAA does not make the NAAQS directly enforceable; however, the CAA does require each state to promulgate a State Implementation Plan (SIP) that provides for implementation, maintenance, and enforcement of the NAAQS in each air quality control region (AQCR) in the state. Title I of the CAA requires Federal actions to conform to the provisions of the approved SIP, which is developed and maintained by the Florida Department of Environmental Protection (FDEP) under Chapter 62 of the Florida Administrative Code (FAC). Title V of the CAA requires identification and characterization of emissions from all minor sources, including aircraft maintenance facilities, fuel storage tanks, and emissions from aircraft and motor vehicles.

The USEPA classifies the air quality within an AQCR according to whether or not the concentration of criteria air pollutants in the atmosphere exceeds primary or secondary NAAQS. All areas within each AQCR are assigned a designation of attainment, nonattainment,

maintenance, unclassifiable attainment, or not designated attainment for each criteria air pollutant. An attainment designation indicates that the air quality within an area is as good as or better than the NAAQS. Nonattainment indicates that air quality within a specific geographical area exceeds applicable NAAQS. Maintenance indicates that an area was previously designated nonattainment but is now attainment. Unclassifiable and not designated indicate that the air quality cannot be or has not been classified on the basis of available information as meeting or not meeting the NAAQS. As defined in the Clean Air Act, areas designated as unclassifiable or not designated are treated as attainment.

As promulgated in Section 62-204.240 of the FAC, the State of Florida has adopted standards equal to or more restrictive than the NAAQS, as in the case of SO_2. The standards, listed in **Table 3.2.1** are reported in parts per million (ppm) or milligram per cubic meter (mg/m^3).

Table 3.2.1 National and State Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards		Florida Standards	
	Level	Averaging Time	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [(1)]	None		9 ppm (10 mg/m^3)	8-hour [(1)]
	35 ppm (40 mg/m^3)	1-hour [(1)]			35 ppm (40 mg/m^3)	1-hour [(1)]
Lead	0.15 $\mu g/m^3$ [(2)]	Rolling 3-Month Average	Same as Primary		None	
	1.5 $\mu g/m^3$	Quarterly Average	Same as Primary		1.5 $\mu g/m^3$	Quarterly Average
Nitrogen Dioxide	53 ppb [(3)]	Annual (Arithmetic Average)	Same as Primary		100 $\mu g/m^3$ (0.05 ppm)	Annual (Arithmetic Average)
	100 ppb	1-hour [(4)]	None		None	
Particulate Matter (PM_{10})	150 $\mu g/m^3$	24-hour [(5)]	Same as Primary		150 $\mu g/m^3$	24-hour [(5)]
	50 $\mu g/m^3$	Annual (Arithmetic Average)	Same as Primary		50 $\mu g/m^3$	Annual (Arithmetic Average)
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual [(6)] (Arithmetic Average)	Same as Primary		None	
	35 $\mu g/m^3$	24-hour [(7)]	Same as Primary			
Ozone	0.075 ppm (2008 std)	8-hour [(8)]	Same as Primary		None	
	0.08 ppm	8-hour [(9)]	Same as Primary		None	

Pollutant	Primary Standards		Secondary Standards		Florida Standards	
	Level	Averaging Time	Level	Averaging Time	Level	Averaging Time
	(1997 std)					
	0.12 ppm	1-hour [(10)]	Same as Primary		0.12 ppm	1-hour [(10)]
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour [(1)]	60 µg/m^3 (0.02 ppm)	Annual (Arithmetic Average)
					0.5 ppm	3-hour
	0.14 ppm	24-hour [(1)]			260 µg/m^3 (0.1 ppm)	24-hour [(1)]
	75 ppb [(11)]	1-hour	None		None	

ppm- parts per million

[(1)] Not to be exceeded more than once per year.

[(2)] Final rule signed October 15, 2008.

[(3)] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard

[(4)] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

[(5)] Not to be exceeded more than once per year on average over 3 years.

[(6)] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.

[(7)] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).

[(8)] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)

[(9)] (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).

[(10)] (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.

[(11)] (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

The General Conformity Rule requires that any Federal action meet the requirements of a SIP or Federal Implementation Plan. The General Conformity Rule applies only to actions in

nonattainment or maintenance areas and considers both direct and indirect emissions MacDill AFB is located in Hillsborough County within the West Central Florida Intrastate Air Quality Control Region (AQCR), as defined in 40 CFR 81.96. According to 40 CFR 81.310, Hillsborough County is in attainment or unclassifiable for all criteria pollutants; therefore, the Conformity Rule does not apply to MacDill AFB.

Title V of the CAA requires state and local agencies to permit major stationary sources. A major stationary source is a facility (i.e., plant, base, or activity) that can emit more than 100 tons per year (tpy) of any one criteria air pollutant, 10 tpy of a hazardous air pollutant, or 25 tpy of any combination of hazardous air pollutants. The purpose of the permitting rule is to establish regulatory control over large, industrial-type activities and monitor their impact on air quality. The Environmental Protection Commission (EPC) of Hillsborough County has received full air permitted delegation from the State. This allows the EPC, exclusively, to conduct permitting determinations, process applications, and issue air pollution permits for most facilities.

Federal Prevention of Significant Deterioration (PSD) regulations also define air pollutant emissions from proposed major stationary sources or modifications to be “significant” if (1) a proposed project is within 10 kilometers of any Class I area, and (2) regulated pollutant emissions would cause an increase in the 24-hour average concentration of any regulated pollutant in the Class I area of 1.0 micrograms per cubic meter ($\mu g/m^3$) or more (40 CFR 52.21(b)(23)(iii)). PSD regulations also define ambient air increments, limiting the allowable increases to any area’s baseline air contaminant concentrations, based on the area’s designation as Class I, II, or III (40 CFR 52.21(c)). MacDill AFB is not within 10 kilometers of a Class I area; therefore, the PSD regulations do not apply.

3.2.2 Baseline Air Emissions

An air emissions inventory is an estimate of total mass emission of pollutants generated from a source or sources over a period of time, typically a year. The quantities of air pollutants are generally measured in pounds per year or tons per year. Emission sources may be categorized as point, area, or mobile emission sources. Point sources are stationary sources, which can be identified by name and operated at a fixed location. Area sources are stationary sources of

emissions too small to track individually, such as gas stations, small office buildings, or open burning associated with agriculture, forest management, and land clearing activities. Mobile sources are vehicles or equipment with gasoline or diesel engines, e.g., an airplane or a ship. Mobile sources are divided into two types, on-road and non-road. On-road mobile sources are vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. Non-road sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles. Accurate air emissions inventories are needed for estimating the relationship between emissions sources and air quality. The most recent (2002) emission inventory data from the USEPA AirData web site (http://www.epa.gov/air/data/geosel.html) for Hillsborough County, which includes MacDill AFB (USEPA, 2002) are provided in **Table 3.2.2** and include point, area, and mobile data.

Table 3.2.2 Stationary Air Emissions Inventory, Hillsborough County, Florida

Criteria Air Pollutant	CO (tpy)	VOC (tpy)	SO_x (tpy)	NO_x (tpy)	PM_{10} (tpy)[3]	$PM_{2.5}$ (tpy)
Point Sources	2,899	56,390	7,434	5,318	65,294	5,318
Area Sources	3,619	1,801	14,944	1,904	596	1,904
Stationary Total	**6,517**	**58,191**	**22,379**	**7,221**	**65,890**	**7,221**
On-road Mobile	228,413	25,546	706	506	1,283	506
Non-road Mobile	94,881	21,593	1,291	1,243	2,597	1,243
Mobile Total	**323,294**	**47,139**	**1,997**	**1,749**	**3,880**	**1,749**
Grand Total	**329,811**	**105,330**	**24,376**	**8,970**	**69,770**	**8,970**

Source: Hillsborough County data summarized from USEPA's Air Data for 2002 (http://www.epa.gov/air/data/index. html)

Radon gas. The level at which the USEPA recommends consideration of radon mitigation measures is 4 picocuries per liter (pCi/L). According to a sampling report obtained from 6 AMDS/SGPB, radon is not considered to be a concern at MacDill AFB (USAF, 1987). All samples analyzed were below the USEPA target levels of 4 pCi/L.

3.3 WATER RESOURCES

3.3.1 Surface Water

Surface water flows at the Base are primarily from stormwater runoff. Topographic maps show that the entire Base is an independent drainage area with no natural surface waters entering or leaving the site prior to final discharge into Tampa Bay. Most of the Base drains toward the southern tip of the Interbay Peninsula; however, the easternmost section of the Base drains toward Hillsborough Bay.

About 25 percent of the Base surface cover is impervious. The soil type is predominantly poorly drained fine sands. Surface water flows on base are primarily storm water runoff. Raccoon Creek and Broad Creek are the only two natural drainage ways and occur on the southern portion of MacDill AFB. A drainage canal that flows through Rattlesnake Road culvert proposed for replacement is a man-made feature and part of the larger drainage system, which consists of approximately 25 miles of culverts, 56 miles of open ditches and canals, and 22.5 acres of artificial impoundments. Most of these features are interconnected and tidally influenced. The two largest surface water impoundments, Lake McClelland and Lewis Lake, total approximately 20 acres and are on the eastern side of the base. There are numerous other small, unnamed retention ponds throughout the base, particularly around the golf course. The coastal plain, which is primarily mangrove swamps, is crisscrossed with drainage canals (USAF 2008b, 2010b).

The USEPA has issued a National Pollutant Discharge Elimination System (NPDES) multi-sector stormwater general permit (No. FLR05E128) in April 2006 and a multi-sector general NPDES permit (No. FLR04E059) to MacDill AFB in March 2008. These permits authorize the discharge of stormwater associated with industrial activity and non-industrial stormwater discharges, respectively. Areas of potential runoff contamination at the Base are the runways and the airfield aprons.

To control for discharges of floating pollutants resulting from accidental spills, the Base maintains a number of boom-type containment systems and absorbents across stormwater channels. The Base also maintains a Spill Prevention Control and Countermeasures (SPCC) Plan

to satisfy 40 CFR 112. Per the same regulation, the base maintains a Facility Response Plan given the location of the Base adjacent to navigable waters and shorelines, as well as the amount of fuel storage capacity existing on site.

3.3.2 Groundwater

There are two aquifer systems underlying MacDill AFB, the surficial aquifer and the Floridan Aquifer. The surficial aquifer system, which consists generally of sand, clayey sand, and shell, is unconfined and is approximately 20 feet thick; however, the surficial aquifer is not used for water supply at MacDill AFB. In residential areas beyond the Base boundaries, small-diameter wells are installed in the surficial aquifer to supply small irrigation systems. The Floridan Aquifer underlies the surficial aquifer and is separated from it by a clay confining layer. The Floridan Aquifer is a major source of groundwater in the region, but is not used for water supply at MacDill AFB. The City of Tampa supplies potable water to MacDill AFB. The primary source of water for the City of Tampa is the Hillsborough River. During the dry season, the City also purchases water from Tampa Bay Water (TBW). This source is supplied from the TBW Aquifer Storage and Recovery (ASR) system, groundwater, surface water, and desalinated seawater supplies. There are no potable water supply wells located on MacDill AFB.

The water table in the surficial aquifer is shallow and ranges from land surface near Tampa Bay and tidal creeks to approximately five feet below land surface at inland locations. Groundwater levels and flow directions generally are determined by low gradients and are tidally influenced by ditches and canals and by Hillsborough and Tampa Bays. The direction of groundwater flow in the surficial aquifer is generally radial from the north-central portion of the Base towards the coastline. Groundwater mounding or a localized elevation of the water table above natural levels has been shown to occur in the golf course area where reclaimed water from the on-base wastewater treatment plant is applied by spray irrigation.

Groundwater quality has been affected by past and present Base activities. Elevated volatile organic compound concentrations have been found in surficial aquifer groundwater at various sites that contain or contained petroleum storage tanks. Elevated metals concentrations have

been found in areas of former landfills. Elevated nitrate, nitrite, and pesticide concentrations have been identified in golf course areas.

3.4 FLOODPLAINS

According to information provided by the Federal Emergency Management Agency (FEMA Maps dated 2008), 80 percent (4,510 acres) of the Base is within the 100-year floodplain. **Figure 3-3** indicates that the residential, industrial, and institutional (education) land uses on the Base are within the 100-year floodplain, along with most of the commercial and aviation support areas. Furthermore, the runway and airfield occupy approximately 80 percent of the remaining land mass outside the floodplain on MacDill AFB and is constrained from being developed for safety reasons (clear zones, noise constraints). Drainage ditches, culvert, roads and sidewalks occupy another 17 percent. Therefore, less than 34 acres (3 percent) are outside the 100-year floodplain and are suitable for development.

Executive Order (E.O.) 11988, *Floodplains Management*, requires Federal agencies to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Federal agencies are required to evaluate the potential effects of any actions it takes in the floodplain to ensure that its planning programs and budget requests reflect consideration of flood hazards and floodplains management. When an action is proposed for location in the floodplain, the Air Force is required to consider alternatives to avoid adverse effects and incompatible development in the floodplain. When the only practicable alternative consistent with the law and with the policy set forth in the E.O. requires siting in the floodplain, the project must be designed or modified to minimize the potential harm to the floodplain. Finally, the agency is required to provide public notice and an opportunity for public comment prior to proceeding with any action in the floodplain.

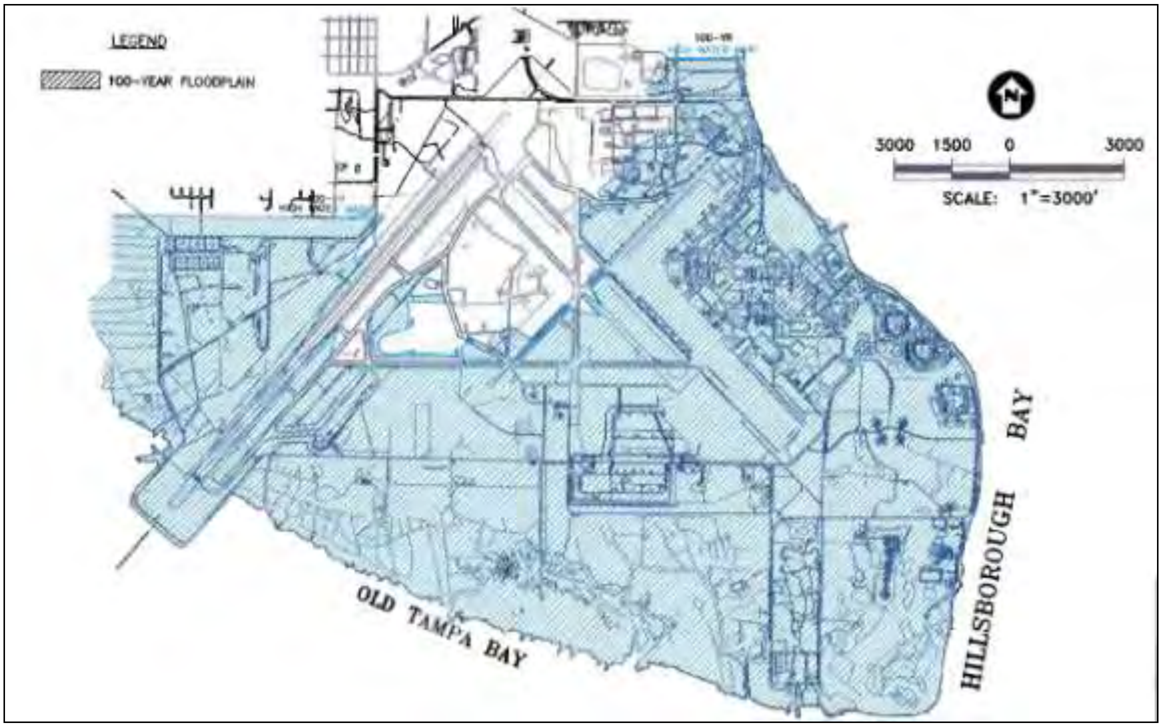

Figure 3-3: Location of 100-year Floodplain on MacDill AFB.

3.5 BIOLOGICAL RESOURCES

3.5.1 Vegetative Communities

Land use on MacDill AFB is designated as either: airfield, urban, industrial, light industrial, commercial, institutional (educational and medical), residential, recreational or improved vacant land. The improved vacant land includes cleared open fields, grassed areas, treated wastewater spray fields, and the golf course. The developed and semi-developed areas on the Base comprise approximately 3,500 acres of the 5,630-acre Base. The undeveloped areas within the Base boundaries have experienced some degree of disturbance, such as ditching, clearing, or the encroachment of exotic vegetation. The unimproved vegetative communities include forested uplands and shrub-scrub wetlands.

3.5.2 Wetlands

The 1998 Wetland Delineation Study identified, delineated, and classified approximately 1,195 acres of wetlands on MacDill AFB (USAF, 1998a). Wetland systems included palustrine wetlands (315 acres) and scrub/shrub wetlands (880 acres). Mangrove wetlands are the principal scrub/shrub wetland community on the Base. Black mangrove (*Avicennia germinans*) and white mangrove (*Laguncularia racemosa*) are the dominant species. Red mangrove (*Rhizophora mangle*) is also present at the waterward fringes of the community. The mangroves have been negatively impacted by historic dredge and fill activities and the excavation of mosquito ditches. However, despite these impacts, this community provides valuable wildlife habitat and is protected by state and local regulations.

A jurisdictional wetland survey performed by an U.S. Army Corps of Engineers (USCOE) certified wetland delineator indicated the locations of Waters of the United States and vegetated wetlands at MacDill AFB (USAF, 1998a). The Proposed Action involves filling, grading and/or draining areas classified as jurisdictional wetlands on the airfield. Rattlesnake Creek runs west of the airfield and is classified as an estuarine scrub/shrub emergent wetland. The tidally influenced Rattlesnake Creek is directly connected to Tampa Bay approximately 250 yards northeast of the Rattlesnake Road culvert. The area in the immediate vicinity of the Rattlesnake

Road culvert is approximately 15 feet wide and roughly two feet deep. Brazilian pepper and mangroves line the banks at the Rattlesnake Road culvert, as the ditch nears Tampa Bay.

3.5.3 Wildlife

Representatives from the Florida Fish and Wildlife Conservation Commission (formerly the Florida Game and Freshwater Fish Commission), National Audubon Society, and the Tampa Bay Sanctuaries completed an evaluation of the wildlife habitat on MacDill AFB in 1992 (Paul, 1992). These surveys determined that the habitat quality ranged from poor to excellent, with the upland forested communities considered poor and the mangrove wetlands considered excellent. The upland forested habitat has been degraded for native fauna due to the suppression of the natural fire cycle, the fragmentation of the habitat, and the invasion of exotic vegetation. The mangrove wetland habitat has been degraded somewhat by the excavation of mosquito ditches and the deposition of spoil within the wetlands. However, the large contiguous habitat area that the mangroves provide and the relative inaccessibility to humans have increased the habitat value.

The surveys also included an evaluation of the wildlife species present and potentially present on the Base. The species observed during the surveys included one reptile, 10 mammals, and 79 birds. Based on the types of habitat available, the survey concluded that 20 reptiles, 17 mammals, and 155 birds might occur within the boundaries of the Base.

3.5.4 Endangered, Threatened, and Special Concern Species

Wildlife species listed by Federal or state agencies as endangered, threatened, or of special concern and known to occur permanently or periodically, or have the potential to occur on the Base are shown in **Table 3.5.4**. The majority of the listed species is associated with the mangrove community and includes shore birds, wading birds, and raptors. These species use the mangrove community primarily for foraging and nesting.

The forested upland communities provide habitat for several state and Federally listed species. The southeastern American kestrel, the burrowing owl, and gopher tortoise have been observed within this community on the Base. Other listed species that may occur in this habitat include gopher frog, Florida pine snake, short-tailed snake, Bachman’s warbler, and Florida mouse. An

American bald eagle nest is located on MacDill AFB; however, the nest is located a significant distance east of the proposed airfield drainage work, and just north of the wetland mitigation sites. A pair of bald eagles has nested on MacDill AFB for more than a decade. Over the last 12 years the eagles have occupied three different nest locations, the first nest was abandoned around 1998 in favor of a new location closer to the South Ramp. The new nest tree location was blown over a few years later during tropical storm Gabriel in September 2001. In 2003, the eagles constructed a new nest in a longleaf pine tree in the middle of the Munitions Storage Area. Although the tree has since succumb to pine beetles, the dead tree is still standing and the nest continues to be occupied during the breeding season. A 660-foot "clear zone" has been established around the nest site.

In 1996, the *Biological Survey of MacDill AFB* and the *Endangered Species Management Plan MacDill AFB* identified the general locations of protected species at MacDill AFB (USAF, 1996a and 1996b). In 2005, MacDill AFB completed an updated Endangered Species Population Survey (USAF, 2005). The Rattlesnake Creek area is part of the Proposed Action. The replacement of a box culvert at Rattlesnake Road would is included as part of the Proposed Action. The Rattlesnake Creek area is classified as high quality, undisturbed habitat. Protected species including, but not limited to, West Indian manatee, White ibis and Wood storks have the potential to occur near the Proposed Action along Rattlesnake Creek.

Table 3.5.4 Summary of Protected Species Identified at MacDill AFB

Common name	Scientific Name	Status	
		Federal	**State**
Reptile/Amphibians			
American alligator	*Alligator mississippiensis*	T (SA)	SSC
Atlantic loggerhead turtle	*Caretta caretta caretta*	T	T
Atlantic green turtle	*Chelonia mydas mydas*	E	E
Gopher tortoise	*Gopherus polyphemus*	-	T
Gopher frog	*Rana capito*	C2	SSC
Florida pine snake	*Pituophis melanoleucus mugitus*	C2	SSC
Short-tailed snake	*Stilosoma extenuatum*	C2	T
Birds			
Roseate spoonbill	*Ajaia ajaja*	-	SSC
Limpkin	*Aramus guarauna*	-	SSC
Burrowing owl	*Athene cunicularia*	-	SSC
Piping plover	*Charadrius melodus*	T	T
Southeastern snowy plover	*Charadrius alexandrinus tenuirostris*	C2	T
Little blue heron	*Egretta caerulea*	C2	SSC
Reddish egret	*Egretta rufescens*	C2	SSC
Snowy egret	*Egretts thula*	-	SSC
Tricolored heron	*Egretta tricolor*	-	SSC
Peregrine falcon	*Falco peregrinus tundris*	T	E
Southeast American kestrel	*Falco sparverius paulus*	C2	E
Florida sandhill crane	*Grus canadensis pratensis*	-	T
American oystercatcher	*Haematopus palliatus*	-	SSC
Bald eagle	*Haliaeetus leucocephalus*	T	T
Wood stork	*Mycteria americana*	E	E
Brown pelican	*Pelecanus occidentalis*	-	SSC
Least tern	*Sterna antillarum*	-	T
Roseate tern	*Sterna dougalii*	T	T
Bachman's warbler	*Vermivora bachmanii*	E	E
Black skimmer	*Rynchops niger*	-	SSC
White ibis	*Eudocimus albus*	-	SSC
Mammals			
Florida mouse	*Podomys floridanus*	C2	SSC
West Indian (FL) manatee	*Trichechus manatus*	E	E
Fish			
No State or Federally listed fish species are known to exist on Base		-	-
Plants			
No State or Federally listed plant species are known to exist on Base		-	-

T=Threatened, T(SA)=Threatened/Similarity of Appearance, E= Endangered, SSC= Species of Special Concern, C2=Candidate for listing

Source: Endangered Species Management Plan, MacDill AFB, Florida (USAF, 1996b)

3.6 AIRSPACE AND AIRFIELD OPERATIONS

The airspace region of influence for MacDill AFB includes a 20-nautical-mile radius from the ground surface up to 10,000 feet above MSL. The Tampa Terminal Radar Approach Control (TRACON) provides radar monitoring and advisories within the region. No special use airspace exists within the region.

The MacDill AFB airfield infrastructure includes a pavement system comprised of the runway, paved overruns, parking/maintenance aprons, aircraft taxiways, and arm/disarm pad. The base's one runway, Runway 04/22, runs northeast to southwest with a parallel taxiway, Taxiway G. The runway is 11,421 feet long by 151 feet wide. Both ends of the runway have 1,000 foot long concrete touchdown zones with asphalt between them.

Aircraft parking is concentrated on the north ramp. All of the KC-135 aircraft assigned to the 6th AMW are parked on the north ramp. The south ramp experiences little use, with the occasional transient aircraft utilizing this ramp space. The NOAA aircraft are generally parked inside Hangar 5. Taxiway K, which runs east and west and Taxiway L, which runs northeast to southwest and intersects Taxiway K., connect the main aircraft-parking apron. Taxiway N originates at the same location as Taxiway L but runs northwest and turns into Taxiway F that connects to Runway 04/22. There is an additional parking apron along Taxiway I.

3.6.1 Bird-Aircraft Strike Hazard

Aircraft collision from birds and other wildlife annually cause millions of dollars in aircraft damage and may result in loss of aircraft and aircrews. The Federal Aviation Authority (FAA) Advisory Circular #150/5200 and Air Force Pamphlet 92-219, Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques (USAF, 2004) provide guidance for reducing the incidents of bird strikes in and around areas where flying operations occur. BASH Management Techniques establish provisions to disperse information on specific bird hazards and procedures for reporting hazardous bird activity. The design and construction of any facilities within the vicinity of the airfield must comply with certain restrictions such as covering open water areas that may encourage food sources or bird foraging activity, and keeping grassed areas cut to regulation height.

3.7 SAFETY AND OCCUPATIONAL HEALTH

A safe environment is one in which there is an absence of or an optimally reduced potential for death, serious bodily injury or illness, or property damage. Human health and safety addresses (1) workers' health and safety during demolition and construction activities and (2) public safety during demolition and construction activities and during subsequent operations of those facilities (Headquarters Air Mobility Command [AMC], 2007).

3.7.1 Construction Safety

Construction site safety is largely a matter of adherence to regulatory requirements imposed for the benefit of employees and implementation of operational practices that reduce risks of illness, injury, death, and property damage. The health and safety of on-site military and civilian workers are safeguarded by numerous DoD and USAF regulations designed to comply with standards issued by the OSHA and USEPA. These standards specify the amount and type of training required for industrial workers, the use of protective equipment and clothing, including hearing protection, engineering controls, and maximum exposure limits for workplace stressors.

All contractors performing construction activities are responsible for following ground safety and OSHA regulations and are required to conduct construction activities in a manner that does not pose a risk to workers or installation personnel. Industrial hygiene programs address exposure to hazardous materials, use of personal protective equipment, and use and availability of Material Safety Data Sheets. Industrial hygiene is the responsibility of contractors and USAF personnel, as applicable.

Industrial hygiene is the responsibility of contractors and USAF personnel, as applicable. Examples of contractor responsibilities include but are not limited to the following:

- To review potentially hazardous workplaces and monitor exposure to workplace chemical (e.g., asbestos, lead, hazardous material), physical (e.g., noise propagation), and biological (e.g., infectious waste) agents;
- To recommend and evaluate controls (e.g., hearing protection, ventilation, respirators) to ensure personnel are properly protected or unexposed; and

- To ensure a medical surveillance program is in place to perform occupational health physicals for those workers subject to any accidental chemical exposures, potentially harmful repetitive physical exposure or engaged in hazardous waste work.

3.7.2 Explosives Safety

Safety fans are associated with the small arms and skeet ranges. Safety fans are buffers that are generated around small arms and skeet ranges to ensure that a minimum safe distance is present within areas where munitions are actively exploded. The Proposed Action includes an option to create a wetland mitigation area within the boundary of a small arms range safety fan **(Figure 1-2)**. Coordination with Combat Arms Training and Maintenance (CATM) would be obtained to ensure safety and to secure proper waivers for personnel working in the area.

3.8 GEOLOGY AND SOILS

Geological resources consist of the earth's surface and subsurface materials. Within a given physiographic province, these resources typically are described in terms of topography, soils, geology, minerals, and, where applicable, paleontology.

Topography. Topography pertains to the general shape and arrangement of a land surface, including its height and the position of its natural and human-made features.

Geology. Geology, which concerns itself with the study of the earth's composition, provides information on the structure and configuration of surface and subsurface features. Such information derives from field analysis based on observations of the surface and borings to identify subsurface composition. Hydrogeology extends the study of the subsurface to water-bearing structures. Hydrogeological information helps in the assessment of groundwater quality and quantity and its movement.

The geological resources information provided in this EA was obtained from the *MacDill Air Force Base General Plan* (USAF, 2010a) and the INRMP (USAF, 2010b). MacDill AFB is in the Pamlico Terrace, which rises gently from the coast to about 25 feet above sea level. Elevations on the base range from sea level at the southern edge to about 15 feet above sea level in the northern portions. Much of the base is less than five feet above mean sea level.

MacDill AFB is situated in the Gulf Coastal Lowlands physiographic region. There are three principal lithologic sequences in the area. The top unit is unconsolidated sand, clay, and marl. This unit might include remnants of the Hawthorn Formation composed of sand, clay, and thin lenses of limestone. Sands in this unit range from five to 20 feet thick with clay layers up to 40 feet thick. This surficial layer is very thin or even absent on the eastern side of the base, and underlying limestone formations sometimes outcrop in this area. The next deepest layer is composed of Tampa and Suwannee Limestones, which range from 250 to 500 feet thick. Below this layer are the Ocala Group; Avon Park, Lake City, and Oldsmar Limestones; and Cedar Keys Limestone, which are about 2,300 feet deep.

Sinkholes are common in the Hillsborough County area, but they are uncommon on MacDill AFB because of overlying impervious layers of clay, limited groundwater recharge, and the presence of a slow discharge zone for the Floridan Aquifer. There has also been considerable amount of fill material used in MacDill AFB. Most of this material originated from dredging activities in the surrounding bays. Erosion is an ongoing problem along Gadsden Point at the southeastern corner of the Bay Palms Golf Complex. There is also a problem with sand washing in the boat channel leading to the base marina.

Soils. Soils are the unconsolidated materials overlying bedrock or other parent material. Soils typically are described in terms of their complex type, slope, and physical characteristics. Differences among soil types in terms of their structure, elasticity, strength, shrink-swell potential, and erosion potential affect their abilities to support certain applications or uses. In appropriate cases, soil properties must be examined for their compatibility with particular construction activities or types of land use.

There are eight soil series, which cover the installation property: Myakka, Urban Land, St. Augustine, Wabasso, Malabar, Arents, Pomello, and Tavares. Two MacDill AFB soils are hydric and thus have jurisdictional wetland implications. Myakka Fine Sand (frequently flooded) is within tidal areas and occurs mainly on mangrove areas. These soils are subject to tidal flooding, are very level, and are poorly drained. Malabar Fine Sand is generally adjacent to the Myakka Fine Sand. This includes flatwood areas, portions of the golf course, and some development. They are nearly level and poorly drained, often occurring in low-lying sloughs and

shallow flatwoods depressions. Myakka is a hydric soil association with Myakka Fine Sand found in tidal areas associated with mangroves. Malabar Fine Sand is also a hydric soil found adjacent to Myakka Fine Sand. There are no prime or unique farmland soils on MacDill AFB.

SECTION 4.0
ENVIRONMENTAL CONSEQUENCES

This section presents an analysis of the potential environmental consequences of the Proposed Action and the No Action Alternative on the environmental resource areas evaluated in **Section 3.0**. The Proposed Action is intended to minimize potential BASH incidents through the construction of Airfield Drainage Improvement Projects at the locations proposed in Section 2.2. The Proposed Action also includes demolition and replacement of the Rattlesnake Road box culvert and its associated roadway bridge, and the creation of two wetland mitigation areas. The No Action Alternative was also considered as an alternative to the implementation of the Proposed Action.

4.1 NOISE

Noise impacts associated with the Proposed Action would result from construction of the Airfield Drainage Improvement Projects, replacement of Rattlesnake Creek culvert and associated restoration at mitigation areas. The degree of noise impacts would be a function of the noise generated by construction equipment, the location and sensitivity of nearby land uses, and the timing and duration of the noise-generating activities. The highest calculated cumulative energy equivalent sound levels from construction activities are estimated to be approximately 85 dB at 50 feet from the center of a project site. Typical noise levels at 50 feet for various equipment that would be used during construction include: 80 dB for bulldozers, 83 dB for cranes, 85 dB for backhoes, and 91 dB for trucks (USEPA, 1971).

The noise associated with the Proposed Action would be categorized as negligible in comparison to surrounding noise sources on the airfield. Although it would involve construction type efforts, the majority of the work would be within the airfield where DNL typically reaches 80 dB. Noise level estimates for the Proposed Action are considered negligible when compared to the noise from aircraft taking off and landing. Trucks delivering clean fill materials would enter through the Tanker Way gate located northwest of the airfield runway. Trucks would utilize portions of three interior roadways (North/West Boundary Boulevard, Perimeter Road and Rattlesnake Road) for a relatively short period of time while entering or exiting the Base. Base functions are

generally located to the eastern side of the runway, and the Tanker Way gate facility and the Defense Fuels Supply Point are the only occupied facilities directly adjacent to these portions of roadway. Wetland mitigation areas are to the southeast of the runway area and within the outer limits of the small arms firing range, and are immediately surrounded by undeveloped land. Therefore, sensitive noise receptors are not located in the immediate vicinity of the airfield or the mitigation areas.

Worker safety concerns associated with airfield noise levels are addressed in the EA under the Safety and Occupational Health section.

In general, negligible impacts would be expected from the short-term increase in noise levels associated with the Proposed Action. Consequently, the Air Force did not conduct further analysis for potential noise impacts.

4.2 AIR QUALITY

4.2.1 Proposed Action

Air quality impacts would occur during construction of the Airfield Drainage Improvement Projects; however, these air quality impacts would be minor and temporary in nature. Fugitive dust (particulate matter) and construction vehicle exhaust emissions would be generated by (1) equipment operation; and (2) entrainment of dust particles by the action of the wind on exposed soil surfaces and debris. The quantity of fugitive dust emissions from the construction site is proportional to the land disturbed and the level of construction activity. These emissions would be greater during the new area site grading. Emissions would vary daily. Equipment travel over temporary roads would generate dust and would fall rapidly within a short distance from the source.

Chapter 62-296.320(4)(c), FAC, requires that no person shall allow the emissions of unconfined particulate matter from any activity (including vehicular movement, transportation of materials, construction, demolition, or wrecking, etc.) without taking reasonable precautions to prevent such emissions. Reasonable precautions include:

- Paving and maintenance of roads, parking areas, and yards;
- Applications of water or chemicals (foam) to control emissions from activities such as demolition, grading roads, construction, and land clearing;
- Application of asphalt, water, or other dust suppressants to unpaved roads, yards, open stock piles, and similar areas;
- Removal of particulate matter from roads and other paved areas under the control of the owner or operator of the facility to prevent reentrainment, and from building or work areas to prevent particulates from becoming airborne; and
- Landscaping or planting of vegetation.

Pollutants from construction equipment and vehicle engine exhausts include NO_x, CO, PM_{10}, $PM_{2.5}$, and VOCs. Internal combustion engine exhausts would be temporary and, like fugitive dust emissions, would not result in long-term impacts.

Additional sensitivity to dust impacts to residential locations should be taken into consideration. In an effort to minimize dust impacts to extent possible in the area of the Staff Officers Quarters (SOQs), efforts would be employed to prevent the staging of equipment and/or any unnecessary materials near the SOQs. Construction fencing and silt screening would be utilized along the border of the SOQs to minimize dust impacts associated with construction. In order to evaluate the air emissions and their impact to the overall region, the emissions associated with Proposed Action activities were compared to the total emissions on a pollutant-by-pollutant basis for the Hillsborough County's 2002 inventory data, as presented in **Section 3.2.2**. Significant impacts to air quality would be the total emissions of any pollutant that equals ten percent or more of the county's emissions for that specific pollutant or if the total emissions of any pollutant equals or exceeds 100 tpy. This criteria approach is used as an indicator for impact analysis to provide a consistent approach to evaluating the impact of construction. Pollutant emission estimates are for both phases of the Proposed Action are presented in **Appendix E** and summarized in **Table 4.2.1**.

Table 4.2.1 Proposed Action Air Emissions at MacDill AFB

Pollutant	Proposed Action Annual Emissions (tpy)	Hillsborough County Emissions Inventory[a] (tpy)	Net Change (%)	*de minimis* Values[b] (tpy)	Above/ Below *de minimis*
CO	0.92	6,517	0.014	100	Below
VOC	0.15	34,880	0.0004	100	Below
NO_X	2.43	58,191	0.0042	100	Below
SO_X	0.05	65,890	0.00007	100	Below
PM_{10}[b]	46.43	22,379	0.208	100	Below
$PM_{2.5}$	4.77	7,221	0.066	100	Below

a Based on stationary emissions presented in Table 3.1.2.
b Source: 40 CFR 93.153, November 30, 1993.
tpy tons per year
% Percent

As shown in **Table 4.2.1**, the Proposed Action would generate emissions well below 10 percent of the emissions inventory for Hillsborough County and are below the *de minimis* values as stated in 40 CFR 93.153(b). In addition, the emissions would be short-term in nature. Therefore, no significant impact on regional or local air quality would result from implementation of the either phase of the Proposed Action.

4.2.2 No Action Alternatives

Because the status quo would be maintained, there would be no impacts to air quality under the No Action Alternative.

4.3 WATER RESOURCES

4.3.1 Proposed Action

Short-term impacts due to a small amount of soil erosion may occur during the Airfield Drainage Improvement Projects since portions of the soil surface would be exposed and disturbed. Soil erosion in areas that are disturbed would be minimized by implementing a sediment and erosion control plan and adopting Best Management Practices (BMPs) such as permanent retention ponds, temporary sediment basins, silt fencing, re-vegetation of disturbed areas, and berms. It is the intent of the airfield drainage project to improve drainage on the airfield by adding a layer of

graded fill and sod in low-lying areas where water ponds during heavy rain events. Erosion from this surface, once the fill and sod is in place, would be short-term and minimal. The Proposed Action would not increase the impervious surface on the Base. There would be minor and insignificant impacts to water resources as a result to the Proposed Action. There would be no long-term impacts to water resources once the project is complete.

The Proposed Action would also involve replacement of the Rattlesnake Road box culvert. Construction of the replacement box culvert could result in impacts to surface water caused by the runoff of disturbed surface soils and increased water turbidity caused by disturbance of side wall and bottom sediments in the ditch. The use of properly installed silt fencing along the edge of the Rattlesnake Creek would significantly reduce inflow of surface soils entrained in stormwater runoff. To reduce the turbidity impacts caused by construction of the replacement box culvert, floating turbidity barriers would be installed across the ditch on either side of the area proposed for installation of the culvert. Turbidity barriers would help contain the sediments that would be entrained in the water column during construction. Upon completion of the construction work in the ditch, the turbidity barriers would be left in place until the entrained sediments have settled out of the water column.

No increase in potable water usage is expected to occur. No impacts to existing water supplies would occur.

4.3.2 No Action Alternative

The No Action Alternative would not complete any of the Airfield Drainage Improvement Project, or construct a replacement box culvert at the Rattlesnake Road drainage ditch; and therefore, there would be no resultant impacts to water resources.

4.4 FLOODPLAINS

In accordance with the requirements of EO 11988, the Air Force must demonstrate that there is no practicable alternative to carrying out the Proposed Action within the flood pool or floodplain. MacDill Air Force Base covers 5,638 acres of land at the southern tip of the Interbay Peninsula. Approximately 80 percent of the land at MacDill, or about 4,510 acres, is located in the 100-year floodplain. A portion of the Proposed Action airfield drainage improvement areas

are located within the 100-year floodplain. It is impossible to improve airfield drainage and avert the 100-year floodplain. There is no practical alternative to completing the minor filling and grading activities in the floodplain. However, there would be no increase in impervious surface as a result of the Proposed Action. Consequently, impacts to the floodplain must be addressed.

4.4.1 Proposed Action

A majority of the areas included in the Proposed Action are located in the 100-year floodplain. In total, the Proposed Action involves grading and/or filling approximately 30.27 acres (1,318,561 square feet) of depression areas or areas with slight topographic irregularities to improve airfield drainage. There are approximately 13.18 acres of total wetland/surface water impacts associates with the Proposed Action including 3.60 acres of temporary impacts and 9.58 acres of permanent impacts. The potential for rainwater to infiltrate the areas surrounding the airfield quickly and evenly may improve slightly as a result of the Proposed Action, due to improvements made to the pervious surfaces around the airfield. The Proposed Action seeks to improve infiltration of rainwater around the airfield, thereby decreasing the potential for flooding. Therefore, the Proposed Action may have a minor benefit on the 100-year floodplain.

In accordance with EO 11988, *Floodplain Management*, the USAF must demonstrate that there is no practicable alternative to construction within a floodplain. The Proposed Action would occur in the 100-year floodplain. However, long-term airfield drainage improvements would not permanently damage floodplain values, including fish and wildlife habitat, or water quality. Nor would the Proposed Action pose a threat to human life, health, or safety. Under the Proposed Action, a minor beneficial impact to the floodplain may occur.

4.4.2 No Action Alternative

The No Action Alternative would not implement any of the Airfield Drainage Improvement Project. This alternative would not reduce bird/aircraft collisions on the airfield or correct the current airfield drainage deficiencies. This alternative would have no impact on floodplain values.

4.5 BIOLOGICAL RESOURCES

4.5.1 Proposed Action

4.5.1.1 Wetlands

In accordance with EO 11990, *Protection of Wetlands*, the USAF must demonstrate that there are no practicable alternatives to carrying out the Proposed Action. EO 11990 applies to new construction and defines that term to include draining, dredging, channelizing, filling, diking, impounding, and related activities and any structures or facilities begun or authorized after the effective date of this Order (May 24, 1977). Implementation of the Proposed Action would have an impact on wetlands.

Many of the low-lying areas on the airfield, proposed to be filled and/or graded, are classified as wetlands. A survey of the entire project area was conducted in order to determine the presence of wetlands as defined by Chapter 62-340 FAC. In total, 9.58 acres of permanent wetland impacts and 3.6 acres of temporary wetland impacts would result from the Proposed Action. Permanent wetland impacts are typically identified as any disturbance that affects the existing wetland soils. This disturbance can include placement of fill material within the wetland or excavation of existing wetland soils. Both disturbance types ultimately result in a loss of wetland area and function. Temporary impacts to wetlands occur when it is necessary to disturb vegetation to complete construction activities or in the case of the Proposed Action, filling activities. Temporary impacts will not permanently alter the hydrologic function of the wetland system being altered. Temporary impacts would be restored after completion of the filling activities as in-kind wetland restoration. The EPC, SWFWMD, and USACE have authorized the wetland impacts subject to mitigation of the impacted wetlands. Mitigation offered to compensate for impacts to wetlands consists of 9.38 acres of wetland creation and 0.63 acres of wetland enhancement within two wetland mitigation areas on MacDill AFB. Proposed creation measures include the installation of mixed scrub and herbaceous plantings. Mitigation of the impacted wetlands would occur concurrent with or before airfield filling and/or grading activities would occur. Given that the required permitting has been completed and proper mitigation of impacted wetlands will result in a net gain of 0.43 acres of created or enhanced wetlands, the

Proposed Action should have a long-term minor benefit to wetlands on MacDill AFB. Development along the coastline in Tampa Bay has resulted in a substantial decline in freshwater wetland systems immediately adjacent to estuarine systems. One of the proposed mitigation projects would create 6.94 acres of new permanent freshwater wetland next to a mangrove estuary, which would have a substantial long-term positive benefit for wetlands in Tampa Bay.

Rattlesnake Creek runs west of the airfield and is classified as an estuarine scrub/shrub emergent wetland. The Proposed Action involves construction activities in Rattlesnake Creek. Minor impacts would result from the replacement of the current box culvert with one of adequate capacity and the subsequent diversion of the creek during construction of the replacement box culvert. The Proposed Action would disturb the soil and vegetation along the canal banks and stir up the bottom sediments in the canal. In the area where the replacement box culvert would be installed, silt fencing would be placed as close to the waters edge as possible to limit runoff of disturbed surface soils. The use of silt fencing should help control increases in water turbidity caused by erosion and runoff. To further reduce water turbidity impacts floating turbidity control barriers would be installed across the canal on either side of the area where the replacement box culvert and associated diversion canal would be installed. Floating turbidity barriers reduce the movement of turbid water and encourage sediment to settle out of the water column. Implementation of these turbidity and erosion control measures should greatly reduce surface water and wetland impacts and should serve as mitigation for the project.

EO 11990 directs each agency to provide for early public review of plans for construction in wetlands. In accordance with EO 11990, construction and extension of the box culverts in the drainage canals would involve coordination with the state (SWFWMD) and Federal (USACE) regulatory agencies. At a minimum, construction of a box culvert would require application for a Notice General permit through the SWFWMD and USACE in accordance with Chapter 40D.400.439 FAC. Permit requirements would be identified during a pre-application meeting with the SWFWMD once funding for the project has been secured.

Consequently, implementation of the Proposed Action would result in a long-term minor benefit to wetlands due to the proper mitigation of impacted wetlands and subsequent a net gain of created or enhanced wetlands on MacDill AFB.

4.5.1.2 Wildlife

Due to an increase in turbidity in the surface water of the creek near the proposed replacement box culvert and associated diversion canal, the Proposed Action could have a minor short-term impact on aquatic life. The proposed construction work would disturb bottom sediments and increase water turbidity. Increased water turbidity can impact aquatic animal life by altering feeding patterns and disorienting aquatic organisms in freshwater environments. The use of erosion and turbidity control structures would substantially reduce the amount and lateral extent of turbidity impacts to surface water, thereby reducing the impacts to aquatic life. It is presumed that any mobile aquatic life, such as fish or invertebrates, would temporarily leave the area while construction activities are occurring and return once construction is completed. Short-term impacts to aquatic organisms could result from the Proposed Action but are considered minor and not significant. No long-term impacts to aquatic life are anticipated.

Short-term impacts to wildlife could result from the Proposed Action and include the temporary disturbance of some avian species that utilize the portion Rattlesnake Creek near the box culvert for feeding. Some avian species, especially the long-legged waders that forage in the drainage canals around the base, would be temporarily displaced from the creek while construction activities are occurring. However, the birds should return to the area upon completion of the replacement box culvert project.

The Proposed Action would deter avian species that utilize the low-lying, seasonally inundated, areas of the airfield for feeding. Under the Proposed Action these low-lying areas would be filled in, thereby decreasing the foraging habitat on the airfield. Other similar, suitable foraging habitat that would avoid bird/aircraft collisions is available on Base for avian species. Consequently, the Proposed Action would have a minor, long-term beneficial impact on avian species at MacDill AFB as the potential for bird/aircraft collisions would be minimized.

4.5.1.3 Listed Species Habitat

The airfield is not critical habitat for any listed species. However, the Rattlesnake Creek area is classified as high quality, undisturbed habitat. Protected species including, but not limited to,

West Indian manatee *(Trichechus manatus),* White ibis *(Eudocimus albus)* and Wood storks *(Mycteria Americana)* have the potential to occur near the Proposed Action along Rattlesnake Creek. **Table 3.5.4** includes the Federally-listed and state-listed species that potentially occur at MacDill AFB. Coordination with the U.S. Fish and Wildlife Service has been completed to insure compliance with the Endangered Species Act. Agency correspondence letters are included in **Appendix B**.

Some listed avian species that use Rattlesnake Creek for feeding could be temporarily displaced during construction of the replacement box culvert at Rattlesnake Road. This is a relatively minor, short-term impact that would not significantly affect listed species on MacDill AFB.

Under the Proposed Action low-lying areas of the airfield would be filled in, thereby decreasing the foraging habitat for listed avian species known to occur at MacDill AFB. Other similar, suitable foraging habitat that would avoid bird/aircraft collisions is available on Base for avian species. Consequently, the Proposed Action would have a minor, long-term beneficial impact on listed avian species at MacDill AFB as the potential for bird/aircraft collisions would be minimized.

4.5.2 No Action Alternative

No new construction or impacts to wetlands would occur with implementation of the No Action Alternative and no impacts to biological resources would occur.

4.6 AIRSPACE/AIRFIELD OPERATIONS AND BIRD-AIRCRAFT STRIKE HAZARD

4.6.1 Proposed Action

The Proposed Action would have a beneficial impact on Airspace/Airfield Operation and BASH. BASH management techniques provide guidance for reducing the incidents of bird strikes in and around areas where flying operations occur. The Proposed Action discourages wildlife from using the airfield through grass management and reducing standing water; thereby, reducing a source of drinking water and a breeding place for insects, amphibians and other food sources for birds.

The Proposed Action would correct existing deficiencies with the drainage system around the runway either through filling, grading and/or draining of low-lying, seasonally inundated areas of the airfield. Therefore, a beneficial impact on Airspace/Airfield Operation and BASH would be expected.

4.6.2 No Action Alternative

Under the No Action Alternative, there would be no impacts to Airspace/Airfield Operation, and no changes in bird-aircraft strike potential would occur. Under the No Action Alternative drainage deficiencies on the airfield would not be corrected, birds would continue to forage in low-lying areas of the airfield, and an increased BASH potential, as compared to the Proposed Action, would remain.

4.7 SAFETY AND OCCUPATIONAL HEALTH

4.7.1 Proposed Action

4.7.1.1 Construction Safety

The Proposed Action would pose safety hazards to the workers similar to those associated with typical industrial construction projects, such as noise, falls, slips, heat stress, and machinery injuries. Construction would not involve any unique hazards and all construction methods would comply with OSHA requirements to ensure the protection of workers and the public during construction. Specifically, safety precautions employed during construction activities, such as construction fencing and increased FOD patrols would be applied to ensure that the Proposed Action does not pose any adverse health or safety risks to airfield personal or aircraft. Governmental oversight of contractor activities would help assure OSHA compliance.

The Proposed Action would involve filling and grading activities on the airfield but would not involve excavations that would likely encounter contaminated soil or groundwater. The Proposed Action is not located within an ERP Site. However, if contaminated media is encountered during construction activities, work would be stopped and the contaminated material would be removed by OSHA Hazardous Waste Operator and Emergency Response 40-hour-certified workers and managed in accordance with ERP guidelines. Implementation of this work

approach would dramatically reduce the potential for impacts to worker health and safety. Consequently, minor and insignificant impacts to safety and occupational health would be incurred with implementation of the Proposed Action.

Construction site safety is largely a matter of adherence to regulatory requirements imposed for the benefit of employees and implementation of operational practices that reduce risks of illness, injury, death, and property damage. The health and safety of on-site military and civilian workers is safeguarded by numerous DoD and USAF regulations designed to comply with standards issued by the OSHA and USEPA. These standards specify the amount and type of training required for industrial workers, the use of protective equipment and clothing, including hearing protection, engineering controls, and maximum exposure limits for workplace stressors.

Base activities that have the highest potential source of noise impacts are the aircraft/airspace operations. The majority of the Proposed Action would occur on the airfield, inside the 80 dB contour.

Industrial hygiene is the responsibility of contractors and USAF personnel, as applicable. Examples of contractor responsibilities include but are not limited to the following:

- To review potentially hazardous workplaces and monitor exposure to workplace chemical (e.g., asbestos, lead, hazardous material), physical (e.g., noise propagation), and biological (e.g., infectious waste) agents;
- To recommend and evaluate controls (e.g., hearing protection, ventilation, respirators) to ensure personnel are properly protected or unexposed; and
- To ensure a medical surveillance program is in place to perform occupational health physicals for those workers subject to any accidental chemical exposures, potentially harmful repetitive physical exposure or engaged in hazardous waste work.

Implementation of this work approach would dramatically reduce the potential for impacts to worker health and safety. Consequently, minor and insignificant impacts to safety and occupational health would be incurred with implementation of the Proposed Action.

4.7.1.2 Explosives Safety

The Proposed Action includes the potential for creation of a wetland mitigation area within the boundary of a small arms range safety fan. The MacDill Grounds Safety Office restricts any type of access within the small arms safety fan during active shooting at the CATM. Consequently, any construction activities within the small arms safety fan would be required to occur when the CATM is inactive. Construction of the proposed mitigation area at the preferred location (within the CATM safety fan) is the first priority. However, if construction of the proposed mitigation site at the preferred location cannot be accomplished during CATM downtimes, an alternative mitigation site has been selected outside of the safety fan. The alternate mitigation site is presented in **Figure 1-2**. Consequently, no impacts to safety and occupational health would be incurred with implementation of the Proposed Action.

4.7.2 No Action Alternative

No impacts on safety and occupational health would be incurred under the No Action Alternative.

4.8 GEOLOGY AND SOILS

4.8.1 Proposed Action

Soils exposed during fill and grading activities and during construction of the replacement box culvert on Rattlesnake Road would be subject to erosion and a small amount of soil erosion is expected during the project since portions of the soil surface would be exposed and disturbed. Soil erosion in areas that are disturbed would be controlled by implementation of a sediment and erosion control plan, which would include implementation of BMPs such as permanent retention ponds, temporary sediment basins, silt fencing, re-vegetation of disturbed areas, and berms. It is the intent of the airfield drainage project to improve drainage on the airfield by adding a clean layer of graded and grassed fill and sod in low-lying areas where water ponds during heavy rain events. Erosion from this surface, once the fill and sod is in place, would be minimal. The Proposed Action would not increase the impervious surface on the Base. Therefore, the impacts to soils would be minimal and temporary and are not considered significant.

4.8.2 No Action Alternative

No impacts to geology and soils would be incurred with implementation of the No Action Alternative.

4.9 INDIRECT AND CUMULATIVE IMPACTS

This section of the EA addresses the potential cumulative impacts associated with the implementation of the Proposed Action and other projects that are occurring concurrently at MacDill AFB. The CEQ defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). This section continues, "Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." The identification of cumulative impacts considers whether significant impacts exists that were not identified when the Proposed Action or Alternative in this EA were considered alone.

NOISE

Actions would be considered to cause significant impacts if they permanently increase ambient noise levels over 65 dBA. Noise emanating from the proposed activities on the airfield would be localized, short-term, and intermittent. It is possible that several different demolition, construction, renovation, or infrastructure activities could occur simultaneously, however, it is likely these projects would occur in different areas. Due to the intermittent nature of construction noise, impacts on the noise environment would not be long term and no significant adverse cumulative impacts on the noise environment would be expected.

The potential cumulative noise impacts at MacDill AFB resulting from the installation aircraft increases and decreases would be contained within the existing noise contours. No significant adverse cumulative impacts on the noise environment would be expected.

AIR QUALITY

Impacts on air quality would be considered significant if the action results in a violation of USEPA air quality standards and regulations. Air emissions generated during implementation of the Proposed Action would be short-term and minor. **Table 4.2.1** presents the air emission totals due to implementation of the Proposed Action. The cumulative air impacts would include air sources from other proposed construction and demolition projects on MacDill AFB during the six-month period needed to complete the Proposed Action. The Proposed Action is expected to be completed within three to six months. Project occurring concurrently include, but are not limited to, the projects identified in **Tables 4.9.1 and 4.9.2**. All of the MacDill projects identified in these tables will have short-term impacts during construction. A summary of the anticipated cumulative impacts relative to the Proposed Action and Alternative is presented below. These discussions are presented for each of the resources described previously.

Table 4.9.3 presents the cumulative air emissions totals due to demolition, construction, renovation, or infrastructure activities implemented simultaneously. If all these projects were to be implemented simultaneously, the proposed emissions would remain below the 10% of regional emissions threshold; USEPA air quality standards and regulations would not be violated. No significant adverse cumulative impacts on air quality would be expected.

Table 4.9.1 Cumulative Construction Projects at MacDill AFB

Other Proposed Construction Projects	
New USCENTCOM HQ & Demo B540	Logistics Readiness Complex (formerly Trans/Supply Complex)
Consolidated Communication Facility	SOCCENT HQ
JCSE Ops & Logistics Mobility Facility	New CATM
MacDill AFB Gate Improvements	New Child Development Center
JCSE Paint Facility	120 Room Dorm
USCENTCOM Parking Garage	Mission Support Facility
Warehouse Complex	JCSE Squadron Facility
Multiple Roadway Improvement Projects	

Table 4.9.2 Cumulative Demolition Projects at MacDill AFB

Facility Number	
500	540
510	541
119	543
317	178
397	3176
398	3500
258	297
2020	1051
1053	265
89	848
860	861
886	JCSE Temp DJC2
1066	373

Details of the other proposed construction and demolition projects are included in **Appendix E**. Pollutant emission estimates are presented in **Appendix E** and summarized in **Table 4.9.3**. Based on the calculations provided in **Appendix E** and presented in **Table 4.9.3**, the cumulative

annual emission estimates fall below the *de minimis* level of 100 tons per year for all five pollutants evaluated.

Table 4.9.3 Cumulative Air Emissions at MacDill AFB

Pollutant	Cumulative Annual Emissions (tpy)	Hillsborough County Emissions Inventory[a] (tpy)	Net Change (%)	*de minimis* Values[b] (tpy)	Above/ Below *de minimis*
CO	25.87	6,517	0.40	100	Below
VOC	7.18	34,880	0.02	100	Below
NO_X	59.86	58,191	0.10	100	Below
SO_X	4.01	65,890	0.01	100	Below
PM10[b]	69.97	22,379	0.31	100	Below
PM2.5	11.99	7,221	0.17	100	Below

a Based on stationary emissions presented in Table 3.1.2.
b Source: 40 CFR 93.153, November 30, 1993.
tpy Tons per year
% Percent

WATER RESOURCES

The significance threshold for surface water and Waters of the U.S. (WUS) include any action that substantially depletes surface water supplies, substantially alters drainage patterns, or results in the loss of WUS that cannot be compensated.

Stormwater. All of the identified projects would not create direct discharge to surface water. It is the intent of the airfield drainage project to improve drainage on the airfield by adding a layer of graded fill and sod in low-lying areas where water ponds during heavy rain events. Erosion from this surface, once the fill and sod is in place, would be minimal. The Proposed Action would not increase the impervious surface on the Base. There would be no long-term impacts to water resources once the project is complete. No significant adverse cumulative impacts on stormwater would be expected.

Wastewater. Implementation of the Proposed Action would have no result on wastewater generation. The other identified demolition, construction, renovation, or infrastructure would

impact wastewater generation. The replacement of existing facilities with more efficient facilities would be expected to reduce the production of wastewater. The proposed construction and renovation projects would use sustainable design concepts to the greatest extent possible. Through the use of sustainable design concepts, the proposed projects would likely result in reduced quantities of wastewater generation compared to current facilities. Beneficial cumulative impacts on the natural gas and wastewater would be expected. Through the use of sustainable design concepts, no significant adverse cumulative impacts on wastewater would be expected.

FLOODPLAINS

Federal and local laws governing floodplains limit development within the 100-year floodplain. Proposed Action and Alternative are located within the 100-year floodplain. The projects conform to applicable floodplain protection standards and accepted flood-proofing and protection measures in accordance with EO 11988. No significant adverse cumulative impacts on the floodplain would be expected. The Proposed Action seeks to improve infiltration of rainwater around the airfield, thereby decreasing the potential for flooding. The collective acreage affected by the Proposed Action and other identified projects are minimal when compared to the available acreage in the drainage basin and no significant adverse cumulative impacts on the drainage basin would be expected. Measures to reduce effects on the 100-year floodplain, such as the detention basins are planned for the new facilities and would be implemented to reduce adverse cumulative effects.

BIOLOGICAL RESOURCES

Wetlands. Many of the low-lying areas on the airfield, proposed to be filled and/or graded, are classified as wetlands. Rattlesnake Creek runs west of the airfield and is classified as an estuarine scrub/shrub emergent wetland. The Proposed Action involves construction activities in Rattlesnake Creek. The EPC, SWFWMD, and USACE have authorized the wetland impacts subject to mitigation of the impacted wetlands. However, adverse impacts to wetlands would be avoided or result in insignificant impacts through the proper use of erosion and floating turbidity control structures and other BMPs, such as permanent retention ponds, temporary sediment

basins, silt fencing, re-vegetation of disturbed areas, and berms. None of the other identified projects impact wetlands. No significant adverse cumulative impacts on wetlands would be expected. Implementation of the Proposed Action would result in a long-term minor benefit to wetlands due to the proper mitigation of impacted wetlands and subsequent a net gain of created or enhanced wetlands on MacDill AFB.

Wildlife. The significance threshold for wildlife and aquatic resources would include a substantial reduction in ecological process, communities, or populations that would threaten the long-term viability of a species or result in the substantial loss of a sensitive community that could not be off-set or otherwise compensated. It is not anticipated that implementation of the Proposed Action and other identified projects would result in the incremental loss of valuable habitat. The Proposed Action would deter avian species that utilize the low-lying, seasonally inundated, areas of the airfield for feeding. Under the Proposed Action these low-lying areas would be filled in, thereby decreasing the foraging habitat on the airfield. Other similar, suitable foraging habitat that would avoid bird/aircraft collisions is available on Base for avian species. The Proposed Action would have a minor, long-term beneficial impact on avian species at MacDill AFB as the potential for bird/aircraft collisions would be minimized. It is not anticipated that implementation of the identified projects would result in the incremental loss of valuable habitat because most projects are proposed in previously developed areas of MacDill AFB and the locations of sensitive habitat are far removed from developed areas. Construction noise would occur which could disturb or aggravate wildlife, but wildlife would likely relocate to other areas on the installation with more suitable habitat during construction and may return to their normal routine when construction activities cease. No significant adverse cumulative impacts on biological resources would be expected.

AIRSPACE/AIRFIELD OPERATIONS AND BIRD-AIRCRAFT STRIKE HAZARD

The design and construction of any facilities within the vicinity of the airfield must comply with certain restrictions such as covering open water areas that may encourage food sources or bird foraging activity, and keeping grassed areas cut to regulation height. The Proposed Action would correct existing deficiencies with the drainage system around the runway either through

filling, grading and/or draining of low-lying, seasonally inundated areas of the airfield. Therefore, a beneficial impact on Airspace/Airfield Operation and BASH would be expected.

SAFETY AND OCCUPATIONAL HEALTH

Light construction (filling and grading) activities associated with the Proposed Action are not expected to increase safety risks. The Proposed Action would not involve construction activities in an ERP site. If contaminated media is encountered during any future construction or demolition activities, work would be stopped and the contaminated material would be removed by OSHA Hazardous Waste Operator and Emergency Response 40-hour-certified workers and managed in accordance with ERP guidelines.

Construction activities would be accomplished in accordance with Federal, state, local and USAF regulations to minimize general construction hazards. The implementation of multi-agency regulations on construction projects minimizes loss of USAF resources and protects USAF personnel from occupational deaths, injuries, or illnesses by managing risks. This instruction applies to all USAF activities. Consequently, no significant adverse cumulative impacts on safety or occupational health would be expected.

GEOLOGY AND SOILS

The grading and filling activities conducted as the Proposed Action would affect geological resources. Planned construction projects could occur simultaneously, but likely in different areas of the installation; these projects would also be spread out over several years. The airfield drainage improvement sites identified under the Proposed Action would be re-vegetated with grass to control erosion and maintain soil stability. Soils exposed during fill and grading activities and during construction would be subject to erosion and a small amount of soil erosion is expected during the project since portions of the soil surface would be exposed and disturbed. MacDill AFB would ensure that BMPs are employed during construction activities to minimize effect on soil and prevent erosion and sediment runoff. All activities would comply with the installation's surface water management plan and would employ erosion-control techniques, such as silt fencing and sediment traps. In addition, MacDill AFB would revegetate, according to the current landscape management plan, which helps with erosion control and soil stability.

Grading, excavation, and recontouring of soil materials would adhere to all Federal, state, and local regulations. No significant adverse cumulative impacts on Geological Resources or soils are expected.

SUMMARY

When the Proposed Action or Alternative are considered in conjunction with past, present, or reasonably foreseeable actions, no significant cumulative impacts would be expected on any resource area.

4.10 COMPARISON OF ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION AND NO ACTION ALTERNATIVE

Table 4.10 is a summary of the potential environmental impacts of the Proposed Action and the No Action Alternative.

Table 4.10 Comparison of Environmental Consequences

Environmental Resources	Proposed Action	No Action Alternative
Air Quality	Short-term - *Minor Adverse* Long-term - No Impact	Short-term - No Impact Long-term - No Impact
Water Resources	Short-term - *Minor Adverse* Long-term - No Impact	Short-term - No Impact Long-term - No Impact
Floodplains	Short-term - *Minor Adverse* Long-term - *Minor Benefit*	Short-term - No Impact Long-term - No Impact
Biological Resources	Short-term - *Minor Adverse* Long-term - *Minor Benefit*	Short-term - No Impact Long-term - No Impact
Airspace/Airfield Operations Bird Aircraft Strike Hazards	Short-term - *Benefit* Long-term - *Benefit*	Short-term - No Impact Long-term - No Impact
Safety and Occupational Health	Short-term - No Impact Long-term - No Impact	Short-term - No Impact Long-term - No Impact
Geology and Soils	Short-term - *Minor Adverse* Long-term - No Impact	Short-term - No Impact Long-term - No Impact
Indirect and Cumulative Impacts	Short-term - No Impact Long-term - No Impact	Short-term - No Impact Long-term - No Impact

4.11 IDENTIFICATION OF THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the No Action Alternative, since this would eliminate impacts to the 100-year floodplain and impacts to wetlands caused by the filling and grading of low-lying areas on the airfield. The No Action Alternative would also eliminate the need for additional contractors and vehicles on Base, would not expend fuels or other resources, or create any wastes.

4.12 UNAVOIDABLE ADVERSE IMPACTS

There are no unavoidable adverse impacts associated with the Proposed Action or No Action Alternative.

4.13 RELATIONSHIP BETWEEN SHORT-TERM USES AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Implementation of the Proposed Action would have a positive effect on long-term productivity by meeting the current and future mission requirements and decreasing the bird/aircraft collision potential on base airfield operation. Implementation of the Proposed Action provides the infrastructure and airfield safety measures required to effectively complete mission goals.

4.14 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action would irreversibly commit fuels, manpower, materials, and costs required to complete the proposed scope of work.

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SECTION 7.0
REFERENCES

Advisory Council on Historic Preservation, 1986	*36 CFR Part 800: Protection of Historic Properties*. U.S. Government Printing Office, Washington, D.C.
Federal Interagency Committee on Urban Noise (FICUN), 1980	Federal Interagency on Committee Urban Noise, Guidelines for Considering Noise in Land Use Planning and Control, June 1980.
Florida Natural Areas Inventory (FNAI), 1996	Florida Natural Areas Inventory, 1996. Biological Survey of MacDill Air Force Base.
Headquarters Air Mobility Command [AMC], 2007	HQ AMC, 2007. Environmental Assessment of Installation Development at MacDill Air Force Base.
Paul, 1992	Paul, R. and A. Schnapf. 1992. MacDill Air Force Base Wildlife Survey. Tampa Bay Sanctuaries, National Audubon Society, Tampa, FL.
State of Florida, 1981	Florida Coastal Management Program.
United States Environmental Protection Agency (USEPA), 2002	National Emission Inventory Database, United States Environmental Protection Agency, AirData Website: http://www.epa.gov/oar/data/neidb.html.
USEPA, 1995	Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, 5th Edition (AP-42), USEPA, Research Triangle Park, January 1995 (Supplement A, February 1996).
USEPA, 1988	Gap Filling PM_{10} Emission Factors for Selected open Area Dust Sources (EPA-450/4-88-003), United States

Environmental Protection Agency, Research Triangle Park, February 1988.

USEPA, 1985 — Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, 4th Edition (AP-42), USEPA, Ann Arbor, September 1985, (Supplement A, January 1991).

USEPA, 1971 — Noise from Construction Equipment and Operation, Building Equipment and Home Appliances.

USAF, 2010a — U.S. Air Force, 2010. MacDill Air Force Base General Plan.

USAF, 2010b — U.S. Air Force, 2010. Integrated Natural Resource Management Plan (INRMP) MacDill Air Force, Florida.

USAF, 2010c — U.S. Air Force, 2010. Title V Permit No. 0570141-001-AV MacDill Air Force Base, Florida.

USAF, 2008a — U.S. Air Force, 2008. Air Installation Compatible Use Zone (AICUZ) Study, MacDill AFB, Tampa.

USAF, 2008b — U.S. Air Force, 2008. Storm Water Pollution Prevention Plan, MacDill AFB, FL.

USAF, 2007a — U.S. Air Force, 2007. Asbestos Management and Operations Plan, MacDill AFB, FL.

USAF, 2007b — U.S. Air Force, 2007. Lead-Based Paint Management Plan, MacDill AFB, FL.

USAF, 2006a — U.S. Air Force, 2006. Integrated Cultural Resources Management Plan (ICRMP) MacDill Air Force, Florida.

USAF, 2005 — U.S. Air Force, 2005. Endangered Species Population Survey, MacDill AFB, Tampa.

USAF, 2004	Bird/Wildlife Aircraft Strike Hazard Management Techniques Bird Strike Hazard, Air Force Pamphlet 92-219 MacDill AFB, Tampa.
USAF, 2003	Economic Resource Impact Statement MacDill Air Force Base, Florida.
USAF, 1998a	U.S. Air Force, 1998. Delineation Study of the Waters of the United States Including the Landward Extent of Wetlands and Surface Waters MacDill Air Force Base Tampa, Hillsborough County, Florida.
USAF, 1998b	U.S. Air Force, 1998. Environmental Compliance Assessment and Management Program (ECAMP), MacDill Air Force Base, Florida.
USAF, 1996a	U.S. Air Force, 1996. Biological Survey of MacDill Air Force Base – Final Report.
USAF, 1996b	U.S. Air Force, 1996. Endangered Species Management Plan MacDill Air Force Base, Florida.
USAF, 1995a	U.S. Air Force, 1995. Environmental Assessment for Implementation of the Integrated Natural Resources Management Plan MacDill Air Force Base, Florida.
USAF, 1994	U.S. Air Force, 1994. Environmental Assessment, Transfer and Reuse of Part of MacDill Air Force Base, Florida.

APPENDIX A

AIR FORCE FORM 813

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REQUEST FOR ENVIRONMENTAL IMPACT ANALYSIS	Report Control Symbol RCS: 02210-02

INSTRUCTIONS:	*Section I to be completed by Proponent. Sections II and III to be completed by Environmental Planning Function. Continue on separate sheets as necessary. Reference appropriate item number(s).*

SECTION I – PROPONENT INFORMATION

1. TO *(Environmental Planning Function)*	2. FROM *(Proponent Organization and functional address symbol)*	2a. TELEPHONE NO.
6 CES/CEV	6 CES/CEVN	DSN 968-2543

3. TITLE OF PROPOSED ACTION

REPAIR AIRFIELD DRAINAGE

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*

See attached

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES (DOPAA) *(Provide sufficient details for evaluation of the total action)*

See attached

6. PROPONENT APPROVAL (Name and Grade)	6a. SIGNATURE	6b. DATE
Jason Kirkpatrick, CIV	Jason Kirkpatrick	22 Jan 10

SECTION II – PRELIMINARY ENVIRONMENTAL SURVEY *(Check appropriate box and describe potential environmental effects including cumulative effects) (+=positive effect; 0=no effect; - = adverse effect; U=unknown effect)*	+	0	-	U
7. AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE *(Noise, accident potential, encroachment, etc.)*				
8. AIR QUALITY *(Emissions, attainment status, state implementation plan, etc.)*				
9. WATER RESOURCES *(Quality, quantity, source, etc.)*				
10. SAFETY AND OCCUPATIONAL HEALTH *(Asbestos/radiation/chemical exposure, explosives safety quantity distance, bird/wildlife aircraft hazard, etc.)*				
11. HAZARDOUS MATERIALS/WASTE *(Use/storage/generation, solid waste, etc.)*				
12. BIOLOGICAL RESOURCES *(Wetlands/floodplains, threatened or endangered species, etc.)*				
13. CULTURAL RESOURCES *(Native American burial sites, archaeological, historical, etc.)*				
14. GEOLOGY AND SOILS *(Topography, minerals, geothermal, Installation Restoration Program, seismicity, etc.)*				
15. SOCIOECONOMIC *(Employment/population projections, school and local fiscal impacts, etc.)*				
16. OTHER *(Potential impacts not addressed above.)*				

SECTION III – ENVIRONMENTAL ANALYSIS DETERMINATION

17.		
		PROPOSED ACTION QUALIFIES FOR CATEGORICAL EXCLUSION (CATEX) #________; OR
	X	PROPOSED ACTION DOES NOT QUALIFY FOR A CATEX; FURTHER ENVIRONMENTAL ANALYSIS IS REQUIRED.

18. REMARKS

MacDill AFB is located in an area that is in attainment for all six criteria pollutants.

19. ENVIRONMENTAL PLANNING FUNCTION CERTIFICATION (Name and Grade)	19 a. SIGNATURE	19 b. DATE
ROBERT B. HUGHES, YF-03 Director, 6th Civil Engineer Squadron		25 JAN 10

4. PURPOSE AND NEED FOR ACTION:

The airfield is the heart of the military mission at MacDill AFB. Originally constructed in the 1940's, the runway and taxiways of the MacDill airfield have been modified and extended over the years. Construction and repair activities around the airfield, particularly in the vicinity of the runway, have resulted in changes to the land surface, leading to unintended changes to the drainage system. Maintenance activities, such as mowing, have formed linear depressions where tractors have created ruts through low lying areas. Additionally, the topography of the airfield area has been changed, even if slightly, over the last 60 years through natural settling of the land, erosion and runoff. Together, these events have resulted in the formation of low lying areas where rainwater is trapped and cannot runoff.

During moderate to severe rain events or during excessively rainy periods, water often ponds in the low lying areas around the runway. The ponded water typically attracts wildlife, particularly birds, which like to forage for food in the temporary pools.

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES:

5.1 Proposed Action: Correct existing deficiencies with the drainage system around the runway to include filling and grading of low-lying areas where stormwater ponds. Restoration of the airfield drainage system have been fully designed and include multiple construction and repair activities. Some of the work focuses on improving drainage and draining areas where water ponds by replacing or repairing blocked culverts and re-grading existing drainage swales and ditches. Other portions of the project focus on improving sheet flow runoff off the airfield by regarding slight topographic irregularities, filling and grading depressional areas, and repairing ditch banks.

> 5.1.1 The project would involve modification, either through filling or draining, to wetland areas around the airfield. Impacts to wetland systems are being coordinated with Federal, state and county regulatory agencies. Permits are being secured through the US Army Corps of Engineers, Southwest Florida Water Management District, and the Environmental Protection Commission of Hillsborough County. In total, the project would result in 9.58 acres of permanent wetland impacts, and 3.6 acres of temporary wetland impacts. Mitigation for wetland impacts has been addressed in the permit applications, and includes construction of two wetland mitigation sites. In total, the wetlands mitigation work would create 9.38 acres of new wetlands and enhance 0.63 acres of existing wetlands. All of the wetlands mitigation work would be accomplished on MacDill AFB property.

5.2 No Action Alternative – The no action alternative involves no restoration or repair to drainage systems on the airfield. This situation would continue to result the presence of low lying areas where water will pond during the rainy season or significant rain events. The presence of shallow water around the runway would continue to attract birds, which will result in a continued Bird Aircraft Strike Hazard for aircraft operating at MacDill. This condition could result in impacts to the military mission by restricting flight time for aircraft operating from the base both for training and operations activities.

6.0. SUPPORTING DOCUMENTATION: The Environmental Planning Function at MAcDill AFB has determined that the Proposed Action is not applicable for a Categorical Exclusion and requires further environmental impact analysis.

7.0 EXECUTIVE ORDER 11988 – FLOODPLAIN MANAGEMENT: The location of the proposed project is located in the 100-year coastal floodplain (Figure 2). Executive Order 11988, Floodplain Management, seeks to avoid construction of facilities or structures within floodplains "to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains". As part of the environmental impact analysis process, this project shall be evaluated for compliance with Executive Order 11988 to ensure that the above referenced goals are met.

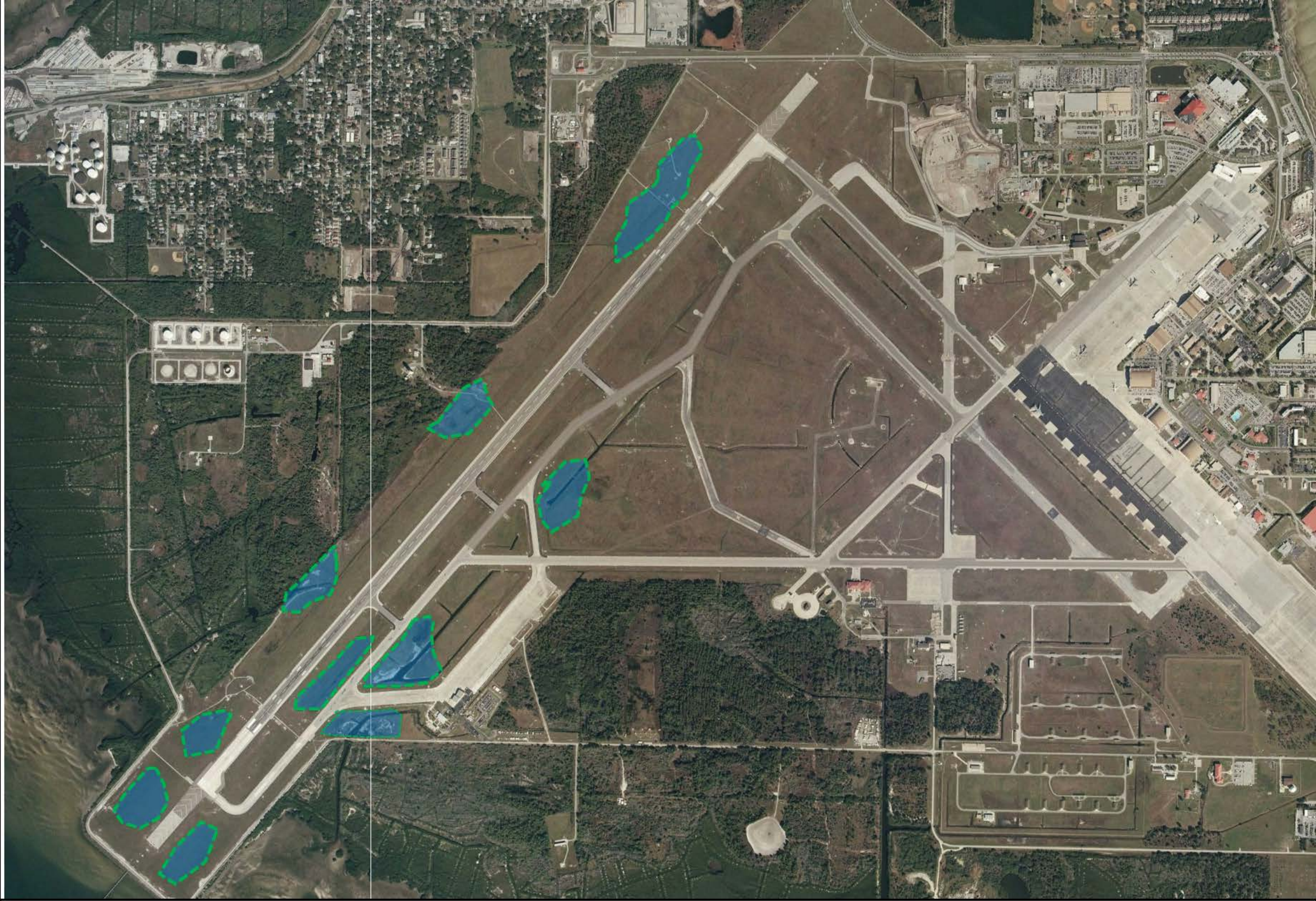

Figure 1 – Location where ponding has been identified near the MacDill AFB runway. Permits are being secured to allow filling, draining, re-grading or a combination of actions to eliminate standing water near the runway.

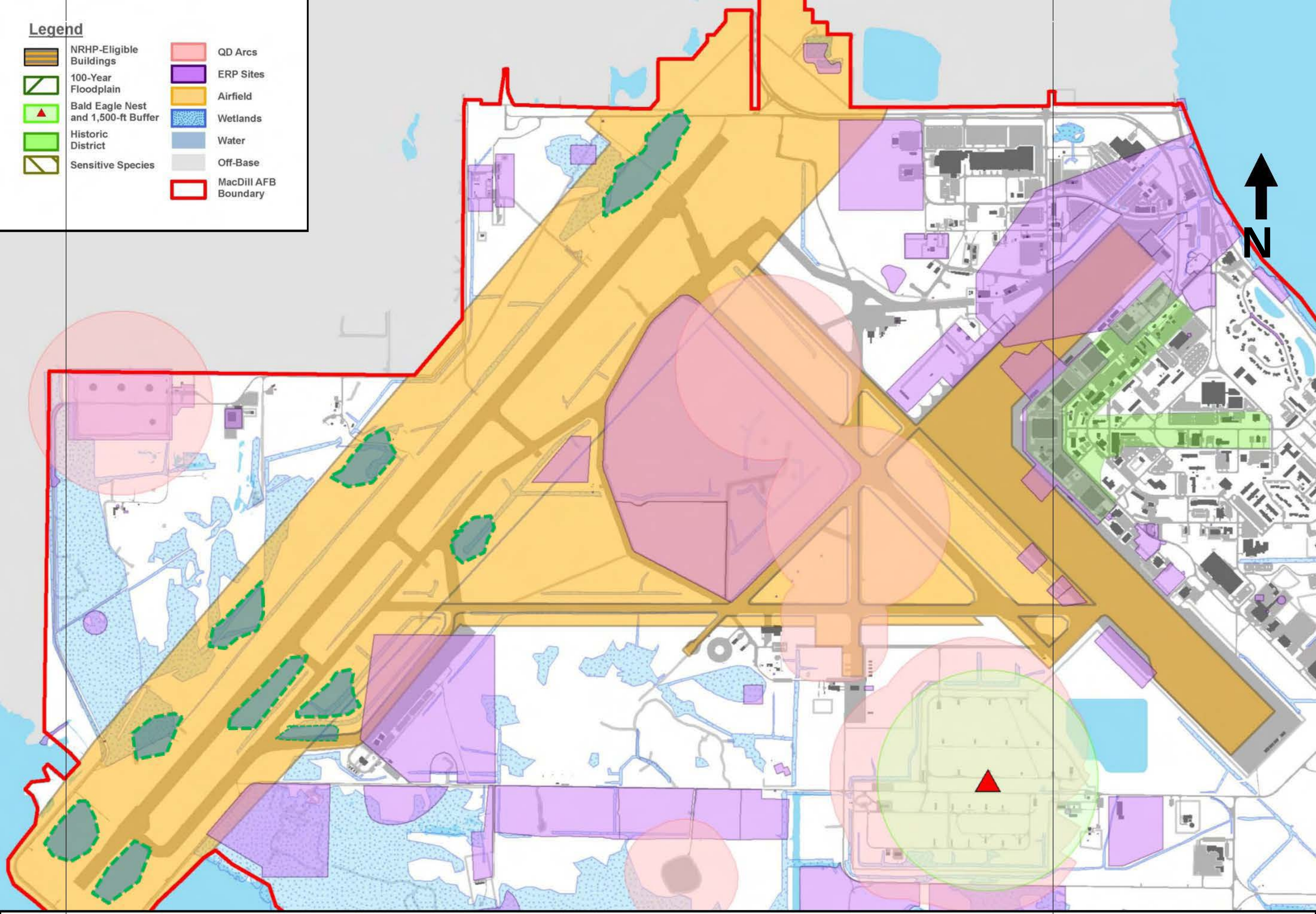

Figure 2 –Shows base environmental constraints overlain against the general locations on the MacDill airfield where proposed airfield drainage repair activities would occur.

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APPENDIX B

PUBLIC NOTICE AND AGENCY COORDINATION LETTERS

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DEPARTMENT OF THE AIR FORCE
6TH AIR MOBILITY WING (AMC)
MACDILL AIR FORCE BASE, FLORIDA

AUG 5 2010

MEMORANDUM FOR DIVISION OF HISTORIC RESOURCES
ATTN: MR. SCOTT EDWARDS
500 SOUTH BRONOUGH STREET
TALLAHASSEE FL 32399

FROM: 6 CES/DD
7621 Hillsborough Loop Dr
MacDill AFB FL 33621

SUBJECT: Implementation of Airfield Drainage Repair Project at MacDill AFB

1. The US Air Force intends to implement an airfield drainage repair project (the Proposed Action) that would correct existing deficiencies with the drainage system around the runway by filling and grading of low-lying areas. The Proposed Action includes restoration of the airfield drainage system through multiple construction and repair activities. Some of the work focuses on improving drainage and draining areas where there is standing water by replacing or repairing blocked culverts and re-grading existing drainage swales and ditches. Other portions of the Proposed Action focus on improving sheet flow runoff off the airfield by regrading slight topographic irregularities, filling and grading depressional areas, and repairing ditch banks. A diagram depicting the locations of the airfield drainage repair projects is attached. At this time, none of the proposed airfield drainage repairs have been constructed.

2. The areas encompassing the Proposed Action have not been identified as cultural resource areas based on an existing archeological survey data for MacDill AFB. Cultural resource Site 8Hi3382 identified as "Runway Site" in the MacDill AFB Integrated Cultural Resources Management Plan is located on the airfield. However, the closest drainage repair site is approximately 650 yards southwest of cultural resources site 8Hi3382 (Figure 1). Consequently, MacDill AFB believes that the proposed airfield drainage repair project would not adversely impact cultural resources. We seek your input on the Proposed Action and our finding of no impact to cultural resources.

3. If you would like to inspect the proposed airfield drainage repair project areas, or if you require additional information on the Proposed Action, please contact Mr. Andrew Rider, 6 CES/CEV, at (813) 828-2718.

ROBERT D. MOORE, YF-03
Deputy Director, 6th Civil Engineer Squadron

Attachment:
Figure – Location of Airfield Drainage Repair Project Areas and Mitigation Areas

ATTACHMENT

Figure 1 Location of Airfield Drainage Repair Projects and Mitigation Areas on MacDill AFB

FLORIDA DEPARTMENT OF STATE
Dawn K. Roberts
Interim Secretary of State
DIVISION OF HISTORICAL RESOURCES

CL [illegible] 13 Sep 10
DD [illegible] 14 Sep 10
CEC RES 15 SEP
CEV ______

received
13 Sept 10 [illegible]

September 8, 2010

Mr. Robert D. Moore
Department of the Air Force
6 CES/DD
7621 Hillsborough Loop Drive
MacDill Air Force Base, Florida 33621

RE: DHR Project File Number: 2010-4030
Proposed Implementation of Airfield Drainage Repair Project at MacDill Air Force Base
Hillsborough County

Dear Mr. Moore:

This office reviewed the referenced project for possible impact to historic properties listed, or eligible for listing, in the *National Register of Historic Places.* The review was conducted in accordance with Section 106 of the *National Historic Preservation Act of 1966*, as amended and *36 CFR Part 800: Protection of Historic Properties.*

Based on the information provided, it is the opinion of this office that the proposed undertaking is not likely to have an effect on historic properties, provided that *MacDill Air Force Base* makes contingency plans in the case of fortuitous finds or unexpected discoveries during ground disturbing activities within the project area:

- If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with early Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the immediate vicinity of such discoveries. The applicant shall contact the Florida Department of State, Division of Historical Resources, Review and Compliance Section at (850) 245-6333. Project activities shall not resume without verbal and/or written authorization. In the event that unmarked human remains are encountered during permitted activities, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, *Florida Statutes*.

If you have any questions concerning our comments, please contact Scott Edwards, Historic Preservationist, by electronic mail *sedwards@dos.state.fl.us*, or at 850.245.6333.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

DEPARTMENT OF THE AIR FORCE
6TH AIR MOBILITY WING (AMC)
MACDILL AIR FORCE BASE, FLORIDA

MEMORANDUM FOR NOAA FISHERIES SERVICE
ATTN: MR. MARK SRAMEK
SOUTHEASTERN REGIONAL OFFICE
263 13TH AVENUE SOUTH
ST PETERSBURG FL 33701

AUG 5 2010

FROM: 6 CES/DD
7621 Hillsborough Loop Dr
MacDill AFB FL 33621

SUBJECT: Implementation of Airfield Drainage Repair Project at MacDill AFB

1. The US Air Force intends to implement an airfield drainage repair project (the Proposed Action) that would correct existing deficiencies with the drainage system around the runway by filling and grading of low-lying areas. The Proposed Action includes restoration of the airfield drainage system through multiple construction and repair activities. Some of the work focuses on improving drainage and draining areas where there is standing water by replacing or repairing blocked culverts and re-grading existing drainage swales and ditches. Other portions of the Proposed Action focus on improving sheet flow runoff off the airfield by regrading slight topographic irregularities, filling and grading depressional areas, and repairing ditch banks. A diagram depicting the locations of the airfield drainage repair projects is attached. At this time, none of the proposed airfield drainage repairs have been constructed.

2. A representative from the MacDill AFB Natural Resources staff surveyed the Proposed Action area to determine if any threatened or endangered species inhabit these areas. No Federally protected threatened and endangered species were observed along or adjacent to the Proposed Action areas. These areas have not been identified as critical habitat for any threatened or endangered species. In addition, the Proposed Action would replace a culvert that is in danger of collapsing, as the headwalls have broken away from the drainage pipe (Figure 2). The damaged culvert will be replaced with a box culvert. A temporary diversion canal is proposed to alter the existing flow of the tidally influenced drainage canal while a replacement culvert is constructed. A temporary diversion canal is proposed to alter the existing flow of the tidally influenced drainage canal while a replacement culvert is constructed. The box culvert will be constructed to span the drainage canal from top-of-bank to top-of-bank. Although the Proposed Action would temporarily disrupt wildlife in the immediate vicinity of the roadway improvement project areas, animals that vacate the area during construction are anticipated to return upon project completion.

3. Impacts to wetland systems are being coordinated with Federal, state, and county regulatory agencies. Permits have been secured through the US Army Corps of Engineers, Southwest Florida Water Management District, and the Environmental Protection Commission of

Hillsborough County. In total, the project would result in 9.58 acres of permanent wetland impacts, and 3.6 acres of temporary wetland impacts. Mitigation for wetland impacts has been addressed in the permit applications, and includes construction of two wetland mitigation sites (Figure 3, Figure 4). In total, the wetlands mitigation work would create 9.38 acres of new wetlands and enhance 0.63 acres of existing wetlands. All of the wetlands mitigation work would be accomplished on MacDill AFB Property.

4. MacDill AFB believes that the proposed airfield drainage repair project would have not adversely impact NOAA resources. We seek your input on the Proposed Action and our finding of no impact to NOAA resources.

5. If you would like to inspect the proposed airfield drainage repair project areas, or if you require additional information on the Proposed Action, please contact Mr. Andrew Rider, 6 CES/CEV, at (813) 828-2718.

ROBERT D. MOORE, YF-03
Deputy Director, 6th Civil Engineer Squadron

Attachments:
Figure 1 – Location of Airfield Drainage Repair Project Areas and Mitigation Areas
Figure 2 – Location of Mitigation Area 1 for the Airfield Drainage Repair Project
Figure 3 – Location of Mitigation Area 2 for the Airfield Drainage Repair Project

ATTACHMENTS

Figure 1 Location of Airfield Drainage Repair Projects and Mitigation Areas on MacDill AFB

Figure 2 - Location of Mitigation Area 1 for Airfield Drainage Repair Project on MacDill AFB

Figure 3 - Location of Mitigation Area 2 for Airfield Drainage Repair Project on MacDill AFB

FYI, NMFS response on the Airfield Drainage Repair.

//Signed//
Andrew W. Rider, P.E., Contractor
6 CES/CEV
Comm: 813-828-2718
DSN: 968-2718

-----Original Message-----
From: Mark Sramek [mailto:Mark.Sramek@noaa.gov]
Sent: Tuesday, August 24, 2010 2:22 PM
To: Rider, Andrew W CTR Contractor AMC 6 CES/CEVW; Kirkpatrick, Jason W CTR Contractor AMC 6 CES/CEVN
Cc: Saunders Mary L SAJ
Subject: Implementation of Airfield Drainage Repair Project at MacDill AFB

NOAA's National Marine Fisheries Service, Southeast Region, Habitat Conservation Division, has reviewed the subject Department of the Air Force, MacDill Air Force Base memorandum dated August 5, 2010, and attachments. Based upon our review of the information and previous field inspection of the project and mitigation areas identified in your memorandum, we anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore,

do not object to authorization of these activities by your agency.

Thank you for your efforts to coordinate these activities with our office in accordance with the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

DEPARTMENT OF THE AIR FORCE
6TH AIR MOBILITY WING (AMC)
MACDILL AIR FORCE BASE, FLORIDA

MEMORANDUM FOR US FISH AND WILDLIFE SERVICE
ATTN: MS. LINDA SMITH
600 4TH STREET SOUTH
ST PETERSBURG FL 32399

AUG 5 2010

FROM: 6 CES/DD
7621 Hillsborough Loop Dr
MacDill AFB FL 33621

SUBJECT: Implementation of Airfield Drainage Repair Project at MacDill AFB

1. The US Air Force intends to implement an airfield drainage repair project (the Proposed Action) that would correct existing deficiencies with the drainage system around the runway by filling and grading of low-lying areas. The Proposed Action includes restoration of the airfield drainage system through multiple construction and repair activities. Some of the work focuses on improving drainage and draining areas where there is standing water by replacing or repairing blocked culverts and re-grading existing drainage swales and ditches. Other portions of the Proposed Action focus on improving sheet flow runoff off the airfield by regrading slight topographic irregularities, filling and grading depressional areas, and repairing ditch banks. A diagram depicting the locations of the airfield drainage repair projects is attached. At this time, none of the proposed airfield drainage repairs have been constructed.

2. A representative from the MacDill AFB Natural Resources staff surveyed the Proposed Action area to determine if any threatened or endangered species inhabit these areas. No Federally protected threatened and endangered species were observed along or adjacent to the Proposed Action areas. These areas have not been identified as critical habitat for any threatened or endangered species. In addition, the Proposed Action would replace a culvert that is in danger of collapsing, as the headwalls have broken away from the drainage pipe (Figure 2). The damaged culvert will be replaced with a box culvert. A temporary diversion canal is proposed to alter the existing flow of the tidally influenced drainage canal while a replacement culvert is constructed. NOAA Fisheries has been consulted regarding potential impacts associated with temporarily altering the existing drainage canal. Although the Proposed Action would temporarily disrupt wildlife in the immediate vicinity of the Proposed Action, animals that vacate the area during construction are anticipated to return upon project completion.

3. Impacts to wetland systems are being coordinated with Federal, state, and county regulatory agencies. Permits have been secured through the US Army Corps of Engineers, Southwest Florida Water Management District, and the Environmental Protection Commission of Hillsborough County. In total, the project would result in 9.58 acres of permanent wetland impacts, and 3.6 acres of temporary wetland impacts. Mitigation for wetland impacts has been addressed in the permit applications, and includes construction of two wetland mitigation sites (Figure 3, Figure 4). In total, the wetlands mitigation work would create 9.38 acres of new

wetlands and enhance 0.63 acres of existing wetlands. All of the wetlands mitigation work would be accomplished on MacDill AFB Property.

4. MacDill AFB believes that the proposed airfield drainage repair project would have no impact to threatened or endangered species that reside on or around MacDill AFB. We seek your input on the Proposed Action and our finding of no impact to USFWS resources.

5. If you would like to inspect the proposed airfield drainage repair project areas, or if you require additional information on the Proposed Action, please contact Mr. Andrew Rider, 6 CES/CEV, at (813) 828-2718.

ROBERT D. MOORE, YF-03
Deputy Director, 6th Civil Engineer Squadron

Attachments:
Figure 1 – Location of Airfield Drainage Repair Project Areas and Mitigation Areas
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Figure 2 - Location of Mitigation Area 1 for Airfield Drainage Repair Project on MacDill AFB

Figure 3 - Location of Mitigation Area 2 for Airfield Drainage Repair Project on MacDill AFB

From: Todd_Mecklenborg@fws.gov
To: Rider, Andrew W CTR Contractor AMC 6 CES/CEVW
Subject: Airfield Drainage Repair Project
Date: Wednesday, September 22, 2010 4:02:01 PM

Mr. Rider,

The implementation of the Airfield Drainage Repair Project at MacDill Airforce Base will have no effect on Federally listed species. No further action is required from this office.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. We are both a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals and commitment to public service.

Todd Mecklenborg, Fish & Wildlife Biologist
U.S. Fish and Wildlife Service
600 Fourth Street South
Saint Petersburg, Florida 33701
(727) 820-3705
www.fws.gov/northfllorida/

Kristin Lehman

From: RIDER, ANDREW W CTR Contractor AMC 6 CES/CEVW [andrew.rider.ctr@us.af.mil]
Sent: Wednesday, April 27, 2011 6:07 AM
To: Kristin Lehman
Subject: FW: MacDill AFB Draft EA for Construction of Airfield Drainage Improvement Projects - State Clearance

Kristin,

Below is the State Clearinghouse Response. They did send it to Dan.

//Signed//
Andy Rider, P.E., Contractor
IAP Worldwide Services
6 CES/CEV
Comm: 813-828-2718
DSN: 968-2718

Please visit MacDill's Environmental SharePoint Web Site.
https://cs.eis.af.mil/a7cportal/eDASH/AMC/macdill/default.aspx

-----Original Message-----
From: Milligan, Lauren [mailto:Lauren.Milligan@dep.state.fl.us]
Sent: Tuesday, April 26, 2011 4:06 PM
To: robert.lewis@atcassociates.com
Cc: RIDER, ANDREW W CTR Contractor AMC 6 CES/CEVW; KIRKPATRICK, JASON W CTR Contractor AMC 6 CES/CEVN
Subject: MacDill AFB Draft EA for Construction of Airfield Drainage Improvement Projects - State Clearance

Mr. R. Daniel Lewis, P.G.

Environmental Division Manager

ATC Associates, Inc.

5602 Thompson Center Court, Suite 405

Tampa, FL 33634

RE: Department of the Air Force - Draft Environmental Assessment for Construction of Airfield Drainage Improvement Projects, MacDill Air Force Base - Hillsborough County, Florida.

SAI # FL201104265744C

Dear Mr. Lewis:

Florida State Clearinghouse staff has received and reviewed the subject Draft Environmental Assessment (EA) under the following authorities: Presidential Executive Order 12372; Section 403.061(42), Florida Statutes; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

Based on the information contained in the Draft EA and issuance of Environmental Resource Permit No. 43-14123.058 by the Southwest Florida Water Management District, the state has determined that the proposed project is consistent with the Florida Coastal Management Program (FCMP). The state's final concurrence of the project's consistency with the FCMP was determined during the environmental permitting process in accordance with Section 373.428, Florida Statutes.

If you have any other questions regarding this message or the state intergovernmental review process, please don't hesitate to contact me at (850) 245-2170 or Lauren.Milligan@dep.state.fl.us. Thank you.

Best regards,

Lauren P. Milligan

Lauren P. Milligan, Environmental Manager Florida State Clearinghouse Florida Department of Environmental Protection 3900 Commonwealth Blvd, M.S. 47 Tallahassee, FL 32399-3000 ph. (850) 245-2170 fax (850) 245-2190

LEGAL ADVERTISEMENT

PUBLIC NOTICE - UNITED STATES AIR FORCE

The Air Force (AF) seeks public comment on AF Environmental Impact Analysis Process (EIAP) documents for the Proposed Construction of Airfield Drainage Improvement Projects at MacDill Air Force Base. The Proposed Action is intended to limit the ponding of surface water on the airfield to reduce the potential for bird/aircraft collisions. The projects would involve modification, through either filling or draining low-lying landscape around the airfield, including wetland areas. Impacts to wetland systems have been coordinated with Federal, state and county regulatory agencies. As part of the Proposed Action, a new box culvert of adequate capacity is proposed to replace the damaged Rattlesnake Creek culvert. MacDill AFB has evaluated this action in accordance with Executive Order 11988 - Floodplain Management, and with Executive Order 11990 - Protection of Wetlands and believes there is no practical alternative to construction within the floodplain or jurisdictional wetlands, primarily drainage canal.

NOTICE OF AVAILABILITY

The EIAP documents satisfy the requirements of the National Environmental Policy Act (NEPA). The documents are available for public review and comment from April 25, 2011 through May 27th, 2011 at the Tampa/Hillsborough County Public Library, located at 900 N. Ashley Drive, Tampa, FL 33606. The documents may be found in the Humanities Section of the Main Library. Address written comments to the 6 AMW Public Affairs, 8209 Hangar Loop Drive, Suite 14, MacDill AFB, FL 33621-5502. The telephone number is (813) 828-2215.

3253 April 25, 2011

The Tampa Tribune

Published Daily

Tampa, Hillsborough County, Florida

rida }
illsborough } SS.

ndersigned authority personally appeared C. Pugh, who on oath says that
dvertising Billing Analyst of The Tampa Tribune, a daily newspaper
Tampa in Hillsborough County, Florida; that the attached copy of the

Metro IN THE Tampa Tribune

of Legal Notices

d in said newspaper in the issues of

04/25/2011

says that the said The Tampa Tribune is a newspaper published at Tampa in
ugh County, Florida, and that the said newspaper has heretofore been
published in said Hillsborough County, Florida, each day and has been entered
ss mail matter at the post office in Tampa, in said Hillsborough County, Florida
one year next preceding the first publication of the attached copy of
; and affiant further says that she has neither paid nor promised any person,
nent for publication in the said newspaper.

C. Pugh

Sworn to and subscribed by me, this 25 day
of April, A.D. 2011

Personally Known ✓ or Produced Identification ___
Type of Identification Produced ___________

Charlotte A. Offner

Notary Public State of Florida
Charlotte A Offner
My Commission DD895783
Expires 06/03/2013

Order # 0003037865 1018532 -- ATC ASSOC. INC

The Tampa Tribune

Published Daily

Tampa, Hillsborough County, Florida

State of Florida }
County of Hillsborough } SS.

Before the undersigned authority personally appeared C. Pugh, who on oath says that she is the Advertising Billing Analyst of The Tampa Tribune, a daily newspaper published at Tampa in Hillsborough County, Florida; that the attached copy of the

Metro IN THE Tampa Tribune

In the matter of Legal Notices

was published in said newspaper in the issues of

04/25/2011

Affiant further says that the said The Tampa Tribune is a newspaper published at Tampa in said Hillsborough County, Florida, and that the said newspaper has heretofore been continuously published in said Hillsborough County, Florida, each day and has been entered as second class mail matter at the post office in Tampa, in said Hillsborough County, Florida for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, this advertisement for publication in the said newspaper.

C. Pugh

Sworn to and subscribed by me, this 25 day
of April, A.D. 2011

Personally Known ✓ or Produced Identification ___
Type of Identification Produced ___________

Charlotte A. Offner

NOTARY PUBLIC STATE OF FLORIDA
Notary Public State of Florida
Charlotte A Offner
My Commission DD895783
Expires 06/03/2013

Order # 0003037865 1018532 -- ATC ASSOC. INC

DEPARTMENT OF THE ARMY PERMIT

Permittee: United States Air Force
MacDill Air Force Base
6 AMW/CC
8202 Hangar Loop Drive, Suite 1
MacDill AFB, Tampa, FL 33621

Permit No: SAJ-2009-00899(IP-MLS)

Issuing Office: U.S. Army Engineer District, Jacksonville

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: Fill, excavate, and drain approximately 9.28 acres of wetland areas, ditches, and ponds, near the MacDill AFB runway to improve drainage in areas adjacent to the MacDill Airfield Runway, eliminating ponding and reducing the risk of Bird Aircraft Strike Hazards. (BASH) The work described above is to be completed in accordance with the 9 pages of drawings and attachments affixed at the end of this permit instrument.

Project Location: The project is located off Tampa Bay, on MacDill Air Force Base, Sections 20, 21, 28, 29, 30, 32, 33 & 34, Township 30 South, Range 18 East, Hillsborough County, Florida.

Directions to site: From the intersection of I-275 and Dale Mabry Highway, proceed south on Dale Mabry for 6.0 miles to MacDill AFB main gate. Proceed 0.2 mile and turn right on North Boundary Blvd. The project site is located immediately to the left.

Latitude & Longitude: Latitude: 27.83957163
Longitude: - 82.52597351

Permit Conditions

General Conditions:

1. The time limit for completing the work authorized ends on July 20, 2015. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to

maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature and the mailing address of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

SECTION 404 SPECIAL CONDITIONS August 13, 2007

1. **Reporting Address:** All reports, documentation and correspondence required by the conditions of this permit shall be submitted to the following address: U.S. Army Corps of Engineers, Regulatory Division, Enforcement Section, P.O. Box 4970, Jacksonville, FL 32232. The Permittee shall reference this permit number, SAJ-2009-00899 (IP-MLS), on all submittals.

2. **Commencement Notification:** Within 10 days from the date of initiating the authorized work, the Permittee shall provide to the Corps a written notification of the date of commencement of work authorized by this permit.

3. **Wetland Avoidance/Minimization Areas:** The Permittee shall avoid the remaining onsite wetlands. These natural wetland areas were avoided as part of the permit application review process and therefore will not be disturbed by any dredging, filling, mechanized land clearing, agricultural activities, or other construction work whatsoever. The Corps reserves the right to deny review of any requests for future impacts to these natural wetland areas.

4. **Erosion Control:** Prior to the initiation of any work authorized by this permit, the Permittee shall install erosion control measures along the perimeter of all work areas to prevent the displacement of fill material. Immediately after completion of the final grading of the land surface, all slopes, land surfaces, and filled areas adjacent to wetlands shall be stabilized using sod, degradable mats, or a combination of similar stabilizing materials to prevent erosion. The erosion control measures shall remain in place and be maintained until all authorized work has been completed and the site has been stabilized.

5. **Compensatory Mitigation:** Within 6 months from the date of initiating the authorized work, the Permittee shall complete the following mitigation objectives in accordance with the approved compensatory mitigation plan as detailed on Drawings 6 & 7 of 9:

a. Mitigation Area 1 - Excavation of spoil material down to the elevation of the adjacent mangrove wetlands, resulting in the creation of 1.23 acres of wetlands and surface waters. Two small channels will be excavated 1 - 2 feet deeper to encourage improved flushing of Coons Creek. Shallow littoral shelves will be excavated in six locations to create oyster bar habitat. Crushed shell will be deposited on the littoral shelves as a substrate for oyster bar development. The areas designated as marsh will be planted with smooth cordgrass plugs on two-foot centers. Tidal flushing should promote the recruitment of mangroves and other native specie.

b. Mitigation Area 2 - is an upland area bordered by canals on three sides. Historically, it was a coastal pine flatwoods, but exotic species, primarily Brazilian pepper and punk tree have invaded the area. The mitigation plan for this site includes creation of three (3) interconnected shallow depressional high marshes. An even shallower shelf will hydrologically connect the marshes, creating a mixed 5.35 acre wetlands. Exotics will be removed and the area will be planted with wax myrtle, sand cordgrass, beakrush, spikerush and giant bulrush.

6. **Performance Standards:** To meet the objectives of the approved compensatory mitigation plan, the Permittee shall achieve the following performance standards:

a. At least 80 percent cover by appropriate wetland species (i.e., FAC or wetter).

b. Cover of Category I and II invasive exotic plant species, pursuant to the most current list established by the Florida Exotic Pest Plant Council at http://www.fleppc.org, and the nuisance species primrose willow (Ludwigia peruviana), dogfennel (Eupatorium capillifolium), Bermudagrass (Cynodon spp.), Bahiagrass (Paspalum notatum), and cattail (Typha spp.). shall total less than 5 percent.

c. Less than 20 percent mortality of planted wetland species.

d. Hydrologic enhancement will result in soils that are saturated to the surface between 5 and 12.5 percent of the growing season.

The Permittee shall achieve the above performance standards by the end of the 5-year monitoring period, with no maintenance during the 5th year of monitoring. In the event that the above performance standards have not been achieved, the Permittee shall undertake a remediation program approved by the Corps in accordance with the **Remediation** Special Condition of this permit.

7. **Monitoring and Reporting Timeframes:** To show compliance with the performance standards the Permittee shall complete the following:

a. Perform a time-zero monitoring event of the wetland mitigation area(s) within 60 days of completion of the compensatory mitigation objectives identified in the **Compensatory Mitigation** Special Condition of this permit.

b. Submit the time-zero report to the Corps within 60 days of completion of the monitoring event. The report will include at least one paragraph depicting baseline conditions of the mitigation site(s) prior to initiation of the compensatory mitigation objectives and a detailed plan view drawing of all created, enhanced and/or restored mitigation areas.

c. Subsequent to completion of the compensatory mitigation objectives, perform semi-annual monitoring of the wetland mitigation areas for the first 3 years and annual monitoring thereafter for a total of no less than 5 years of monitoring.

d. Submit annual monitoring reports to the Corps within 60 days of completion of the monitoring event. Semi-annual monitoring will be combined into one annual monitoring report.

e. Monitor the mitigation area(s) and submit annual monitoring reports to the Corps until released in accordance with the **Mitigation Release** Special Condition of this permit.

8. **Reporting Format:** Annual monitoring reports shall follow a 10-page maximum report format for assessing compensatory mitigation sites. The Permittee shall submit all documentation to the Corps on 8½-inch by 11-inch paper, and include the following:

a. Project Overview (1 Page):

(1) Department of the Army Permit Number

(2) Name and contact information of Permittee and consultant

(3) Name of party responsible for conducting the monitoring and the date(s) the inspection was conducted

(4) A summary paragraph defining the purpose for the approved project, acreage and type of aquatic resources impacted, and mitigation acreage and type of aquatic resources authorized to compensate for the aquatic impacts

(5) Written description on the location and any identifiable information to locate the site perimeter(s)

(6) Directions to the mitigation site (from a major highway)

(7) Dates compensatory mitigation commenced and/or was completed

(8) Short statement on whether the performance standards are being met

(9) Dates of any recent corrective or maintenance activities conducted since the previous report submission

(10) Specific recommendations for any additional corrective or remedial actions.

b. Requirements (1 page): List the monitoring requirements and performance standards, as specified in the approved mitigation plan and

special conditions of this permit, and evaluate whether the compensatory mitigation project site is successfully achieving the approved performance standards or trending towards success.

c. Summary Data (maximum of 4 pages): Data shall be provided to substantiate the success and/or potential challenges associated with the compensatory mitigation project. Any photo documentation shall be dated and clearly labeled with the direction from which the photo was taken, and be identified on the appropriate maps.

d. Maps (maximum of 3 pages): Maps shall be provided to show the location of the compensatory mitigation site relative to other landscape features, habitat types, locations of photographic reference points, transects, sampling data points, and/or other features pertinent to the mitigation plan.

e. Conclusions (1 page): A general statement shall be included describing the conditions of the compensatory mitigation project. If performance standards are not being met, a brief explanation of the difficulties and potential remedial actions proposed by the Permittee, including a timetable, shall be provided.

9. **Remediation:** If the compensatory mitigation fails to meet the performance standards 5 years after completion of the compensatory mitigation objectives, the compensatory mitigation will be deemed unsuccessful. Within 60 days of notification by the Corps that the compensatory mitigation is unsuccessful, the Permittee shall submit to the Corps an alternate compensatory mitigation proposal sufficient to create the functional lift required under the permit The alternate compensatory mitigation proposal may be required to include additional mitigation to compensate for the temporal loss of wetland function associated with the unsuccessful compensatory mitigation activities. The Corps reserves the right to fully evaluate, amend, and approve or reject the alternate compensatory mitigation proposal. Within 120 days of Corps approval, the Permittee will complete the alternate compensatory mitigation proposal.

10. **Mitigation Release:** The Permittee's responsibility to complete the required compensatory mitigation, as set forth in the **Compensatory Mitigation** Special Condition of this permit will not be considered fulfilled until mitigation success has been demonstrated and written verification has been provided by the Corps. A mitigation area which has been released will require no further monitoring or reporting by the Permittee; however the Permittee, Successors and subsequent Transferees remain perpetually responsible to ensure that the mitigation area(s) remain in a condition appropriate to offset the authorized impacts in accordance with General Condition 2 of this permit.

11. **Self-Certification:** Within 60 days of completion of the authorized work or at the expiration of the construction window of this permit, whichever occurs first, the Permittee shall complete the attached "Self-Certification Statement of Compliance" form (Attachment 3) and submit to the Corps. In the event that the completed work deviates, in any manner, from the authorized work, the Permittee shall describe, on the Self-Certification Form, the deviations between the work authorized by the permit and the work as constructed. Please note that the description of any deviations on the Self-Certification Form does not constitute approval of any deviations by the Corps.

12. **Fill Material**: The Permittee shall use only clean fill material for this project. The fill material shall be free from items such as trash, debris, automotive parts, asphalt, construction materials, concrete block with exposed reinforcement bars, and soils contaminated with any toxic substance, in toxic amounts in accordance with Section 307 of the Clean Water Act.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal projects.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE) 17 AUG 10
(DATE)

ROBERT B. HUGHES, YF-03
Director, 6th Civil Engineer Squadron

(PERMITTEE NAME-PRINTED)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Charles A. Schnepel Aug 27, 2010

(DISTRICT ENGINEER) (DATE)

Alfred A. Pantano, Jr.
Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

_______________________________________ _____________________ (TRANSFEREE-SIGNATURE) (DATE)

____
(NAME-PRINTED)

____
(ADDRESS)

____
(CITY, STATE, AND ZIP CODE)

Attachments to Department of the Army Permit Number SAJ-2009-00899

1. PERMIT DRAWINGS: 9 pages, dated May 21, 2009

2. WATER QUALITY CERTIFICATION: Specific Conditions of the water quality permit/certification in accordance with General Condition number 5 on page 2 of this DA permit. 13 pages.

3. Self Certification of Compliance

ENVIRONMENTAL PROTECTION COMMISSION
HILLSBOROUGH COUNTY

Executive Director
Richard D. Garrity, Ph.D.

Roger P. Stewart Center
3629 Queen Palm Dr. • Tampa, FL 33619
Ph: (813) 627-2600

Fax Numbers (813):

Admin.	627-2620	Waste	627-2640
Legal	627-2602	Wetlands	627-2630
Water	627-2670	ERM	627-2650
Air	627-2660	Lab	272-5157

CL M 18Dec09
DD RDM 23DEC09
CEC U 28DEC09.
CEV leave

received
17 Dec 09

9 December 2009

Mr. Kevin Shelton
Ash Engineering, Inc.
4902 Eisenhower Boulevard
Suite 380
Tampa, Florida 33634-6323

SUBJECT: WETLAND IMPACT AND MITIGATION AUTHORIZATION FOR MAC DILL AIR FORCE BASE AIRFIELD DRAINAGE IMPROVEMENT PROJECT / SITE PLAN DATED RECEIVED 13 NOVEMBER 2009 / REQUEST DATED RECEIVED 18 FEBRUARY 2009, ADDITIONAL INFORMATION DATED RECEIVED 04 MAY 2009/ REVISED MITIGATION PLAN DATED RECEIVED 13 NOVEMBER 2009 / REVISED UMAM WORKSHEETS DATED RECEIVED 19 NOVEMBER 2009/ STR'S 20 & 29-30-18

Dear Mr. Shelton:

The Wetlands & Watershed Management Division staff of the Environmental Protection Commission of Hillsborough County (EPC) has completed a review of the subject application to impact wetlands in Hillsborough County. The permanent wetland impacts result from the regrading of the MacDill AFB runway to prevent wildlife hazards in Accordance with FAA circular# 150/5200 and Air Force Pamphlet 91-212. The applicant demonstrated sufficient justification for the wetland and compensation for the wetland impact will be provided. Therefore, this letter shall serve as documentation that the EPC Executive Director authorizes the wetland impacts subject to the conditions and comments enumerated below:

1. Only those wetland impacts identified in the table below are authorized for impact:

Wetland Impact ID#	Type system	Acreage of impact
D	shrub	1.53
H	herbaceous	1.19
I	herbaceous	0.19
K	herbaceous	0.25
L1-L5	herbaceous	3.12
M1-M4	shrub	0.38
N1-N3	herbaceous	1.09
O	herbaceous	1.83
Temporary impacts	herbaceous	3.6
Total		9.58 permanent & 3.6 temporary

Mitigation area #	acres	Type Mitigation
1	1.2	Creation / herbaceous
2	5.37	Creation / herbaceous-shrub
2	0.63	Enhancement/ herbaceous-shrub
2	1.57	Open water
3	1.24	Creation / herbaceous-shrub
Total		
	9.38	Creation
	0.63	Enhancement

2. Mitigation offered to compensate for impacts to the wetlands consists of 9.38 ac. acres of wetland creation and 0.63 acres of wetland enhancement. Proposed creation measures include the installation of mixed shrub and herbaceous plantings. The approved planting plan and detail specifications are provided in the "The MacDill Air Force Base Airfield Ponding" dated received by the EPC 13 November 2009.

3. Utilizing the Uniform Mitigation Assessment Method outlined in Chapter 62-345, F.A.C., it was determined that the proposed impacts for this project will result in the loss of 4.02 functional units, while the proposed mitigation areas creation will result in the gain of 4.91 functional units.

4. The wetland mitigation area must be planted and monitored in accordance with the provided mitigation plan (dated received by EPC 13 November 2009). This information must also be included on the detailed mitigation sheets and on the final construction set provided to EPC staff.

<u>**General Comments/ Conditions:**</u>

- This approval is valid for a period of two and one half years from the date of this letter **(expiration date 26 May 2012)**. If the site plans are altered or the time period for the allotted encroachment expires, this impact approval will become invalid.

- This approval applies only to the development proposal as submitted, and in no way does it provide EPC approval to any other aspect of the EPC review process. In addition, this approval does not imply exemption from obtaining all proper permits from other governmental agencies.

- Any activity interfering with the integrity of wetland(s), such as clearing, excavating, draining or filling, without written authorization from the Executive Director of the EPC or his authorized agent, pursuant to Section 1-11.07, Rules of the Commission, would be a violation of Section 17 of the Environmental Protection Act of Hillsborough County, Chapter 84-446, and of Chapter 1-11, Rules of the EPC.

Be advised, the applicant is encouraged to publish, at their own expense, notice of this binding letter in the legal advertisements section of a newspaper of general circulation. Publication will

extinguish third party rights to challenge the determination 20 days after the date of publication, unless a party specifically asked for a copy of the notice prior to issuance of the agency action. Choosing not to publish notice of this determination will allow third party challenges to remain open. If you choose to publish the proposed agency action, it should be published in substantially the following format:

Environmental Protection Commission
Notice of Proposed Agency Action

The EPC gives notice of its intent to approve a wetland impacts and mitigation in reference to **["The MacDill Air Force Base Airfield Ponding" dated received by the EPC 13 November 2009]**. Complete copies of the wetland impact and mitigation plans are available for public inspection, by appointment, during normal business hours 9:00a.m. to 5:00p.m., Monday through Friday at the EPC Wetland Division office, 3629 Queen Palm Drive, Tampa, FL 33619. Any person whose interests protected by Chapter 84-446, Laws of Florida, are adversely affected by this action has the right to appeal this wetland delineation. Written Notice of Appeal must be received by the Chairperson of the EPC, at 601 East Kennedy Blvd., Tampa, Florida 33602, within **twenty (20) days** of receipt of this notice and must state specifically what part of the action or decision is appealed and must specifically set forth the reasons for your objection. A copy of the Notice of Appeal must also be sent to the EPC's Legal Department, Environmental Protection Commission of Hillsborough County, 3629 Queen Palm Drive, Tampa, Florida 33619, facsimile (813) 627-2602.

Thank you for your cooperation. If you require additional information, please contact Mr. Tom LaFountain at (813) 627-2600, extension 1220.

Sincerely,

Richard D. Garrity, Ph.D., Executive Director
Environmental Protection Commission
of Hillsborough County

cc: Tom LaFountain, EPC
Lawrence Martin, Colonel, USAF

tflf/mst/wr

NOTICE OF RIGHTS

Pursuant to Section 9 of the Hillsborough County Environmental Protection Act, Chapter 84-446, as amended, Laws of Florida, (EPC Act) and Rule 1-2.30, Rules of the Environmental Protection Commission of Hillsborough County (EPC), any person whose interests are protected by Chapter 84-446, Laws of Florida and who is adversely affected or otherwise aggrieved by this action has the right to appeal this action. **Written Notice of Appeal for a Section 9 Administrative Hearing must be received by the Chairperson of the EPC, at 601 East Kennedy Blvd., Tampa, Florida 33602, within twenty (20) days of receipt of this notice** and pursuant to Section 1-2.30(c), Rules of the EPC, must include the following information:

(1) The name, address, and telephone number of the Appellant; the name, address, and telephone number of the Appellant's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the Appellant will be aggrieved or how his or her interests will be adversely affected by the Executive Director's decision;
(2) A statement of when and how the Appellant received notice of the agency decision;
(3) A statement of all disputed issues of material fact. If there are none, the Notice of Appeal must so indicate;
(4) The specific facts the Appellant contends warrant reversal or modification of the Executive Director's proposed action;
(5) A statement of the specific laws or rules the Appellant contends require reversal or modification of the Executive Director's proposed action; and
(6) A statement of the relief sought by the Appellant, stating precisely the action Appellant wishes the Commission to take with respect to the Executive Director's proposed action or decision.

A copy of the Notice of Appeal for a Section 9 Administrative Hearing must also be sent to the EPC's Legal Department, Environmental Protection Commission of Hillsborough County, 3629 Queen Palm Dr., Tampa, Florida 33619, facsimile (813) 627-2602, phone (813) 627-2600. Pursuant to Section 1-2.31, Rules of the EPC, you may request additional time to file a Notice of Appeal by filing a **Request for Extension of Time to file a Notice of Appeal.** The Request for Extension of Time must be sent to and received by the EPC Legal Department at the address above within twenty (20) days of receipt of this notice.

This Wetland Impact and Mitigation Authorization is final unless the party timely files, pursuant to Chapter 1-2, Part IV, Rules of the EPC, a Notice of Appeal or files a Request for Extension of Time to file a Notice of Appeal for a formal hearing. Pursuant to Section 1-2.31(e), Rules of the EPC, failure to request an administrative hearing by filing a Notice of Appeal within 20 days after receipt of this order shall constitute a waiver of one's right to have an appeal heard, and this unappealed order shall automatically become a final and enforceable order of the Commission.

Upon receipt of a sufficient Notice of Appeal for a Section 9 Administrative Hearing an independent hearing officer will be assigned. The hearing officer will schedule the appeal hearing at the earliest reasonable date. Following an evidentiary hearing, the hearing officer will render his/her decision as a recommendation before the EPC board. Pursuant to Section 1-2.35, Rules of the EPC, the EPC board will take final agency action on the findings of fact and conclusions of law of the hearing officer. A written decision will be provided by the EPC board, which affirms, reverses or modifies the hearing officer's decision. Should this final administrative decision still not be in your favor, you may seek review in accordance with Section 9 of the Hillsborough County Environmental Protection Act, Chapter 84-446, as amended, Laws of Florida, and the Administrative Procedure Act, Chapter 120, part II, Florida Statutes, 1961 by filing an appeal under rule 9.110 of the Florida Rules of Appellate Procedure, with the clerk of the Environmental Protection Commission, EPC Legal Department, 3629 Queen Palm Dr., Tampa, FL 33619, and filing a notice of appeal accompanied by the applicable filing fee with the Second District Court of Appeal within 30 days from the date of the final administrative decision becoming an order of the Commission.

Copies of EPC rules referenced in this Wetland Impact and Mitigation Authorization may be examined at any EPC office, may be found on the internet site for the agency at http://www.epchc.org or may be obtained by written request to the EPC Legal Department at 3629 Queen Palm Dr., Tampa, FL 33619.

Southwest Florida
Water Management District

2379 Broad Street, Brooksville, Florida 34604-6899
(352) 796-7211 or 1-800-423-1476 (FL only)
TDD only: 1-800-231-6103 (FL only)
On the Internet at WaterMatters.org

An Equal Opportunity Employer

Bartow Service Office
170 Century Boulevard
Bartow, Florida 33830-7700
(863) 534-1448 or
1-800-492-7862 (FL only)

Sarasota Service Office
6750 Fruitville Road
Sarasota, Florida 34240-9711
(941) 377-3722 or
1-800-320-3503 (FL only)

Tampa Service Office
7601 Highway 301 North
Tampa, Florida 33637-6759
(813) 985-7481 or
1-800-836-0797 (FL only)

February 3, 2010

Colonel Lawrence M. Martin, Jr.
6th Air Mobility Wing, USAF
8208 Hanger Loop Drive, Suite 1
MacDill AFB, FL 33621

Subject: **Final Agency Action Transmittal Letter**
ERP Individual Construction
Permit No.: 43014123.058
Project Name: MacDill AFB - Airfield Drainage Improvements
County: Hillsborough
Sec/Twp/Rge: 20, 21, 28, 29, 30, 32, 33, 34/30S/18E

Dear Colonel Martin:

This letter constitutes notice of Final Agency Action for **approval** of the permit referenced above. Final approval is contingent upon no objection to the District's action being received by the District within the time frames described below.

You or any person whose substantial interests are affected by the District's action regarding a permit may request an administrative hearing in accordance with Sections 120.569 and 120.57, Florida Statutes, (F.S.), and Chapter 28-106, Florida Administrative Code, (F.A.C.), of the Uniform Rules of Procedure. *A request for hearing must: (1) explain how the substantial interests of each person requesting the hearing will be affected by the District's action, or proposed action, (2) state all material facts disputed by the person requesting the hearing or state that there are no disputed facts, and (3) otherwise comply with Chapter 28-106, F.A.C.* Copies of Sections 28-106.201 and 28-106.301, F.A.C. are enclosed for your reference. A request for hearing must be filed with (received by) the Agency Clerk of the District at the District's Brooksville address within 21 days of receipt of this notice. Receipt is deemed to be the fifth day after the date on which this notice is deposited in the United States mail. Failure to file a request for hearing within this time period shall constitute a waiver of any right you or such person may have to request a hearing under Sections 120.569 and 120.57, F.S. Mediation pursuant to Section 120.573, F.S., to settle an administrative dispute regarding the District's action in this matter is not available prior to the filing of a request for hearing.

Enclosed is a "Noticing Packet" that provides information regarding the District Rule 40D-1.1010, F.A.C., which addresses the notification of persons whose substantial interests may be affected by the District's action in this matter. The packet contains guidelines on how to provide notice of the District's action, and a notice that you may use.

The enclosed approved construction plans are part of the permit, and construction must be in accordance with these plans.

If you have questions concerning the permit, please contact F. Jackson Moore, P.E., at the Tampa Service Office, extension 2041. For assistance with environmental concerns, please contact Chastity A. Collins, extension 2092.

Sincerely,

Alba E. Más

Alba E. Más, P.E., Director
Tampa Regulation Department

AEM:FJM:CAC:gjn
Enclosures: Approved Permit w/Conditions Attached
Approved Construction Drawings
Statement of Completion
Notice of Authorization to Commence Construction
Noticing Packet (42.00-039)
Sections 28-106.201 and 28-106.301, F.A.C.
cc/enc: File of Record 43014123.058
Eugene R. Masters, Ph.D., P.E., Ash Engineering, Inc.
US Army Corps of Engineers
Robert B. Hughes, 6th Civil Engineer Squadron

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
ENVIRONMENTAL RESOURCE
INDIVIDUAL CONSTRUCTION
PERMIT NO. 43014123.058

Expiration Date: February 3, 2015

PERMIT ISSUE DATE: February 3, 2010

This permit is issued under the provisions of Chapter 373, Florida Statutes, (F.S.), and the Rules contained in Chapters 40D-4 and 40, Florida Administrative Code, (F.A.C.). The permit authorizes the Permittee to proceed with the construction of a surface water management system in accordance with the information outlined herein and shown by the application, approved drawings, plans, specifications, and other documents, attached hereto and kept on file at the Southwest Florida Water Management District (District). Unless otherwise stated by permit specific condition, permit issuance constitutes certification of compliance with state water quality standards under Section 401 of the Clean Water Act, 33 U.S.C. 1341. All construction, operation and maintenance of the surface water management system authorized by this permit shall occur in compliance with Florida Statutes and Administrative Code and the conditions of this permit.

PROJECT NAME: MacDill AFB - Airfield Drainage Improvements

GRANTED TO: 6th Air Mobility Wing, USAF
8208 Hanger Loop Drive, Suite 1
MacDill AFB, FL 33621

ABSTRACT: This permit will authorize the construction of drainage improvements to the existing surface water management system in the areas adjacent to the MacDill Air Force Base (AFB) airfield. The proposed drainage improvements will minimize existing standing water in the vicinity of the active runways to decrease the potential for bird/aircraft collisions. The proposed improvements, which include re-grading and culvert replacements, will maintain existing drainage patterns and will not add any new impervious surfaces. All surface water runoff from the existing runways will continue to sheet flow over broad vegetated areas prior to entering the existing/proposed drainage system that conveys the runoff directly to downstream Tampa Bay. There are 13.79-acres of total wetland/surface water impacts associated with the proposed project including 4.23-acres of temporary impacts and 9.56-acres of permanent impacts. The wetland/surface water impacts will be offset by the creation of three onsite wetland mitigation areas totaling 14.27-acres.

OP. & MAINT. ENTITY: 6th Civil Engineer Squadron

COUNTY: Hillsborough

SEC/TWP/RGE: 20, 21, 28, 29, 30, 32, 33, 34/30S/18E

TOTAL ACRES OWNED OR UNDER CONTROL: 5,638.0

PROJECT SIZE: 49.05 Acres

LAND USE: Government

DATE APPLICATION FILED: February 18, 2009

AMENDED DATE: N/A

I. Water Quantity/Quality

The proposed project will not add any new impervious surfaces and runoff from the existing runways will continue to sheet flow over broad vegetated areas prior to discharging directly to Tampa Bay. No water quality or quantity impacts are anticipated.

A mixing zone is not required.
A variance is not required.

II. 100-Year Floodplain

Encroachment (Acre-Feet of fill)	Compensation (Acre-Feet of excavation)	Compensation Type	Encroachment Result (feet)
0.00	0.00	N/A	N/A

III. Environmental Considerations

Wetland/Other Surface Water Information **Count: 18**

Wetland/Other Surface Water Name	Total Acres	Not Impacted Acres	Permanent Impacts		Temporary Impacts	
			Acres	Functional Loss*	Acres	Functional Loss*
Mitigation Area 2 Wetland	0.63	0.00	0.00	0.00	0.63	0.00
Wetland A	0.06	0.00	0.00	0.00	0.06	0.00
Wetland C	0.08	0.00	0.00	0.00	0.08	0.00
Wetland D1-D3	1.53	0.00	1.53	0.51	0.00	0.00
Wetland E & E1	1.53	0.00	0.00	0.00	1.53	0.00
Wetland G	0.09	0.00	0.00	0.00	0.09	0.00
Wetland H	1.19	0.00	1.19	0.32	0.00	0.00
Wetland I	0.19	0.00	0.19	0.00	0.00	0.00
Wetland K	0.25	0.00	0.25	0.00	0.00	0.00
Wetland L1-L5	3.12	0.00	3.12	1.87	0.00	0.00
Wetland M	0.39	0.00	0.00	0.00	0.39	0.00
Wetland M1-M4	0.38	0.00	0.38	0.22	0.00	0.00
Wetland N	0.80	0.00	0.00	0.00	0.80	0.00
Wetland N1-N3	1.09	0.00	1.09	0.36	0.00	0.00
Wetland O	1.83	0.00	1.81	0.54	0.02	0.00
Wetland P	0.37	0.00	0.00	0.00	0.37	0.00
Wetland S	0.22	0.00	0.00	0.00	0.22	0.00
Wetland T	0.04	0.00	0.00	0.00	0.04	0.00
Total:	13.79	0.00	9.56	3.82	4.23	0.00

*** For impacts that do not require mitigation, their functional loss is not included.**

Wetland/Other Surface Water Comments:
There is a total of 13.79-acres of wetlands and surface waters located within the defined project area. With the exception of Wetland E, Wetland L, Wetland M, and Wetland N, the systems located in the airfield are freshwater marshes comprised mainly of wetland grasses. These wetlands are regularly mowed as part of the maintenance for the airfield. Wetland E, Wetland M, and Wetland N are brackish, surface water ditches which exhibit wetland herbaceous vegetation along the edges. Wetland L is a mangrove swamp adjacent to Tampa Bay on the south side of the airfield. All of the wetlands and surface waters have been disturbed by the military base activities adjacent to them. 4.23-acres of the wetlands will be temporarily impacted, while the rest, 9.56-acres, will be permanently impacted. The 3.82 units of function loss for these systems were determined utilizing the Uniform Mitigation Assessment Method (UMAM).

Mitigation Information **Count of Mitigation: 4**

Mitigation Name	Creation/Restoration		Enhancement		Preservation		Other	
	Acres	Functional Gain	Acres	Functional Gain	Acres	Functional Gain	Acres	Functional Gain
Mitigation Area 1	1.20	0.68	0.00	0.00	0.00	0.00	0.00	0.00
Mitigation Area 2	6.94	3.47	0.00	0.00	0.00	0.00	0.00	0.00
Mitigation Area 2 Enhancement	0.00	0.00	0.63	0.11	0.00	0.00	0.00	0.00
Mitigation Area 3	1.24	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Total:	9.38	4.89	0.63	0.11	0.00	0.00	0.00	0.00

Mitigation Comments:
Mitigation Area 1 is the creation of a 1.20-acre mangrove swamp, planted with *Spartina alterniflora* with created oyster beds. Mitigation Area 1 is hydrologically connected with Tampa Bay, and its creation will improve water flushing within the area. Mitigation Area 2 is designed to be a freshwater marsh with three deeper open water pools. There are three existing depressional freshwater wetlands which will be enhanced through the creation of the 6.94-acre freshwater marsh. Mitigation Area 3 is creation of a saltwater marsh adjacent to Tampa Bay. Mitigation Area 3 will be planted with *Spartina patens, Borrichia frutescens, and Iva frutescens.* The wetland creation and enhancement was reviewed using the UMAM and will provide 5.00-units of functional gain to offset the wetland impacts. An excess of 1.18-units of functional gain will be available for future development associated with this permit.

Wetland/ Other Surface Water impacts and related mitigation
Wetland/ Other Surface Water: Wetland D1-D3
Impact Area(s): Impact D1-D-3
Mitigation: Mitigation Area 2

Wetland/ Other Surface Water: Wetland H
Impact Area(s): Impact H
Mitigation: Mitigation Area 2

Wetland/ Other Surface Water: Wetland L1-L5
Impact Area(s): Impact L1-L5
Mitigation: Mitigation Area 1Mitigation Area 2Mitigation Area 3

Wetland/ Other Surface Water: Wetland M1-M4
Impact Area(s): Impact M1-M4
Mitigation: Mitigation Area 2

Wetland/ Other Surface Water: Wetland N1-N3
Impact Area(s): Impact N1-N3
Mitigation: Mitigation Area 2

Wetland/ Other Surface Water: Wetland O
Impact Area(s): Impact O 1
Mitigation: Mitigation Area 2

SPECIFIC CONDITIONS

1. If the ownership of the project area covered by the subject permit is divided, with someone other than the Permittee becoming the owner of part of the project area, this permit shall terminate, pursuant to Section 40D-1.6105, F.A.C. In such situations, each land owner shall obtain a permit (which may be a modification of this permit) for the land owned by that person. This condition shall not apply to the division and sale of lots or units in residential subdivisions or condominiums.

2. Unless specified otherwise herein, two copies of all information and reports required by this permit shall be submitted to:

   Tampa Regulation Department
   Southwest Florida Water Management District
   7601 U.S. Highway 301 North
   Tampa, FL 33637-6759

   The permit number, title of report or information and event (for recurring report or information submittal) shall be identified on all information and reports submitted.

3. The Permittee shall retain the design engineer, or other professional engineer registered in Florida, to conduct on-site observations of construction and assist with the as-built certification requirements of this project. The Permittee shall inform the District in writing of the name, address and phone number of the professional engineer so employed. This information shall be submitted prior to construction.

4. Within 30 days after completion of construction of the permitted activity, the Permittee shall submit to the Tampa Service Office a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing the required Statement of Completion and Request for Transfer to Operation Entity form identified in Chapter 40D-1.659, F.A.C., and signed, dated and sealed as-built drawings. The as-built drawings shall identify any deviations from the approved construction drawings.

5. The District reserves the right, upon prior notice to the Permittee, to conduct on-site research to assess the pollutant removal efficiency of the surface water management system. The Permittee may be required to cooperate in this regard by allowing on-site access by District representatives, by allowing the installation and operation of testing and monitoring equipment, and by allowing other assistance measures as needed on site.

6. WETLAND MITIGATION SUCCESS CRITERIA MITIGATION AREA - Area 1

   Mitigation is expected to offset adverse impacts to wetlands and other surface waters caused by regulated activities and to achieve viable, sustainable ecological and hydrological wetland functions. Wetlands constructed for mitigation purposes will be considered successful and will be released from monitoring and reporting requirements when the following criteria are met continuously for a period of at least one year without intervention in the form of irrigation or the additional or removal of vegetation.

   a. The mitigation area can reasonably be expected to develop into a Saltwater Marsh (642) as determined by the Florida Land Use and Cover and Forms Classification System (third edition; January 1999).

   b. Topography, water depth and water level fluctuation in the mitigation area are characteristic of the wetlands/ surface water type specified in criterion "a".

   c. Planted or recruited herbaceous or shrub species (or plant species providing the same function) shall meet the criteria specified:

ZONE	STRATUM	% COVER	SPECIES	SUBDOMINANT SPECIES
F	1.25' - 1.50'	85	*Spartina alterniflora*	None Specified
G	1.46' - 1'	85	*Avicennia germinans*	None Specified

   d. Species composition of recruiting wetland vegetation is indicative of the wetland type specified in criterion "a".

e. Coverage by nuisance or exotic species does not exceed five percent at any location in the mitigation site and five percent for the entire mitigation site.

f. The wetland mitigation area can be determined to be a wetland or other surface water according to Chapter 62-340, F.A.C.

This criterion must be achieved within five years of mitigation area construction. The Permittee shall complete any activities necessary to ensure the successful achievement of the mitigation requirements by the deadline specified. Any request for an extension of the deadline specified shall be accompanied with an explanation and submitted as a permit letter modification to the District for evaluation.

The mitigation area may be released from monitoring and reporting requirements and be deemed successful at any time during the monitoring period if the Permittee demonstrates that the conditions in the mitigation area have adequately replaced the wetland and surface water functions affected by the regulated activity and that the site conditions are sustainable.

WETLAND MITIGATION SUCCESS CRITERIA MITIGATION AREA - Area 2

Mitigation is expected to offset adverse impacts to wetlands and other surface waters caused by regulated activities and to achieve viable, sustainable ecological and hydrological wetland functions. Wetlands constructed for mitigation purposes will be considered successful and will be released from monitoring and reporting requirements when the following criteria are met continuously for a period of at least one year without intervention in the form of irrigation or the additional or removal of vegetation.

a. The mitigation area can reasonably be expected to develop into a Freshwater Marsh (641) as determined by the Florida Land Use and Cover and Forms Classification System (third edition; January 1999).

b. Topography, water depth and water level fluctuation in the mitigation area are characteristic of the wetlands/ surface water type specified in criterion "a".

c. Planted or recruited herbaceous or shrub species (or plant species providing the same function) shall meet the criteria specified:

ZONE	STRATUM	% COVER	SPECIES	SUBDOMINANT SPECIES
A	3' - 4'	85 30 30	*Spartina bakeri* *Baccharis augustifolia* *Myrica cerifera*	None Specified None Specified *Cephalanthus occidentalis*
B	2' - 3'	85	*Sagittaria lancifolia* *Juncus effusus*	None Specified None Specified
C	1' - 2'	85	*Scirpus californicus*	None Specified

d. Planted or recruited tree species that area greater than or equal to 12 feet in height and established for more than five years shall meet the criteria specified:

e. Species composition of recruiting wetland vegetation is indicative of the wetland type specified in criterion "a".

f. Coverage by nuisance or exotic species does not exceed five percent at any location in the mitigation site and five percent for the entire mitigation site.

g. The wetland mitigation area can be determined to be a wetland or other surface water according to Chapter 62-340, F.A.C.

This criterion must be achieved within five years of mitigation area construction. The Permittee shall complete any activities necessary to ensure the successful achievement of the mitigation requirements by the deadline specified. Any request for an extension of the deadline specified shall be accompanied with an explanation and submitted as a permit letter modification to the District for evaluation.

The mitigation area may be released from monitoring and reporting requirements and be deemed successful at any time during the monitoring period if the Permittee demonstrates that the conditions in the mitigation area have adequately replaced the wetland and surface water functions affected by the regulated activity and that the site conditions are sustainable.

WETLAND MITIGATION SUCCESS CRITERIA MITIGATION AREA - Area 3

Mitigation is expected to offset adverse impacts to wetlands and other surface waters caused by regulated activities and to achieve viable, sustainable ecological and hydrological wetland functions. Wetlands constructed for mitigation purposes will be considered successful and will be released from monitoring and reporting requirements when the following criteria are met continuously for a period of at least one year without intervention in the form of irrigation or the additional or removal of vegetation.

a. The mitigation area can reasonably be expected to develop into a Saltwater Marsh (642) as determined by the Florida Land Use and Cover and Forms Classification System (third edition; January 1999).

b. Topography, water depth and water level fluctuation in the mitigation area are characteristic of the wetlands/ surface water type specified in criterion "a".

c. Planted or recruited herbaceous or shrub species (or plant species providing the same function) shall meet the criteria specified:

ZONE	STRATUM	% COVER	SPECIES	SUBDOMINANT SPECIES
D	3'	85	*Spartina patens*	*Sesuvium portulacastrum*
		85	*Borrichia frutescens*	None Specified
		30	*Iva frutescens*	None Specified

d. Species composition of recruiting wetland vegetation is indicative of the wetland type specified in criterion "a".

e. Coverage by nuisance or exotic species does not exceed five percent at any location in the mitigation site and five percent for the entire mitigation site.

f. The wetland mitigation area can be determined to be a wetland or other surface water according to Chapter 62-340, F.A.C.

This criterion must be achieved within five years of mitigation area construction. The Permittee shall complete any activities necessary to ensure the successful achievement of the mitigation requirements by the deadline specified. Any request for an extension of the deadline specified shall be accompanied with an explanation and submitted as a permit letter modification to the District for evaluation.

The mitigation area may be released from monitoring and reporting requirements and be deemed successful at any time during the monitoring period if the Permittee demonstrates that the conditions in the mitigation area have adequately replaced the wetland and surface water functions affected by the regulated activity and that the site conditions are sustainable.

7. The Permittee shall monitor and maintain the wetland mitigation areas until the criteria set forth in the Wetland Mitigation Success Criteria Conditions above are met. The Permittee shall perform corrective actions identified by the District if the District identifies a wetland mitigation deficiency.

8. The Permittee shall undertake required maintenance activities within the wetland mitigation areas as needed at any time between mitigation area construction and termination of monitoring, with the exception of the final year. Maintenance shall include the manual removal of all nuisance and exotic species, with sufficient frequency that their combined coverage at no time exceeds the Wetland Mitigation Success Criteria Conditions above. Herbicides shall not be used without the prior written approval of the District.

9. A Wetland Mitigation Completion Report shall be submitted to the District within 30 days of completing construction and planting of the wetland mitigation areas. Upon District inspection and approval of the mitigation areas, the monitoring program shall be initiated with the date of the District field inspection being the construction completion date of the mitigation areas. Monitoring events shall occur between March 1 and November 30 of each year. An Annual Wetland Monitoring Report shall be submitted upon the anniversary date of District approval to initiate monitoring.

   Annual reports shall provide documentation that a sufficient number of maintenance inspection/activities were conducted to maintain the mitigation areas in compliance with the Wetland Mitigation Success Criteria Conditions above. Note that the performance of maintenance inspections and maintenance activities will normally need to be conducted more frequently than the collection of other monitoring data to maintain the mitigation areas in compliance with the Wetland Mitigation Success Criteria Conditions above.

   Monitoring Data shall be collected annually.

10. Termination of monitoring for the wetland mitigation areas shall be coordinated with the District by:

    a. notifying the District in writing when the criteria set forth in the Wetland Mitigation Success Criteria Conditions have been achieved;

    b. suspending all maintenance activities in the wetland mitigation areas including, but not limited to, irrigation and addition or removal of vegetation; and

    c. submitting a monitoring report to the District one year following the written notification and suspension of maintenance activities.

    Upon receipt of the monitoring report, the District will evaluate the wetland mitigation sites to determine if the Mitigation Success Criteria Conditions have been met and maintained. The District will notify the Permittee in writing of the evaluation results. The Permittee shall perform corrective actions for any portions of the wetland mitigation areas that fail to maintain the criteria set forth in the Wetland Mitigation Success Criteria Conditions.

11. Following the District's determination that the wetland mitigation has been successfully completed, the Permittee shall operate and maintain the wetland mitigation areas such that they remain in their current or intended condition for the life of the surface water management facility. The Permittee must perform corrective actions for any portions of the wetland mitigation areas where conditions no longer meet the criteria set forth in the Wetland Mitigation Success Criteria Conditions.

12. The Permittee shall commence construction of the mitigation areas within 30 days of wetland impacts, if wetland impacts occur between February 1 and August 31. If wetland impacts occur between September 1 and January 31, construction of the mitigation areas shall commence by March 1. In either case, construction of the mitigation areas shall be completed within 120 days of the commencement date unless a time extension is approved in writing by the District.

13. The construction of all wetland impacts and wetland mitigation shall be supervised by a qualified environmental scientist/specialist/consultant. The Permittee shall identify, in writing, the environmental professional retained for construction oversight prior to initial clearing and grading activities.

14. Wetland buffers shall remain in an undisturbed condition except for approved drainage facility construction/maintenance.

15. The following boundaries, as shown on the approved construction drawings, shall be clearly delineated on the site prior to initial clearing or grading activities:

    a. wetland and surface water areas,
    b. wetland buffers, and
    c. limits of approved wetland impacts.

    The delineation shall endure throughout the construction period and be readily discernible to construction and District personnel.

16. The District, upon prior notice to the Permittee, may conduct on-site inspections to assess the effectiveness of the erosion control barriers and other measures employed to prevent violations of state water quality standards and avoid downstream impacts. Such barriers or other measures should control discharges, erosion, and sediment transport during construction and thereafter. The District will also determine any potential environmental problems that may develop as a result of leaving or removing the barriers and other measures during construction or after construction of the project has been completed. The Permittee must provide any remedial measures that are needed.

17. This permit is issued based upon the design prepared by the Permittee's consultant. If at any time it is determined by the District that the Conditions for Issuance of Permits in Rules 40D-4.301 and 40D-4.302, F.A.C., have not been met, upon written notice by the District, the Permittee shall obtain a permit modification and perform any construction necessary thereunder to correct any deficiencies in the system design or construction to meet District rule criteria. The Permittee is advised that the correction of deficiencies may require re-construction of the surface water management system and/or mitigation areas.

18. If prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at anytime within the project site area, the permitted project should cease all activities involving subsurface disturbance in the immediate vicinity of such discoveries. The Permittee, or other designee, should contact the Florida Department of State Division of Historical Resources, Review and Compliance Section at (850) 245-6333 or (800) 847-7278, as well as the appropriate permitting agency office. Project activities should not resume without verbal and/or written authorization from the Division of Historical Resources. In the event that unmarked human remains are encountered during permitted activities, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, *Florida Statutes*.

GENERAL CONDITIONS

1. The general conditions attached hereto as Exhibit "A" are hereby incorporated into this permit by reference and the Permittee shall comply with them.

Authorized Signature

EXHIBIT "A"

1. All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.

2. This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by District staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.

3. For general permits authorizing incidental site activities, the following limiting general conditions shall also apply:

   a. If the decision to issue the associated individual permit is not final within 90 days of issuance of the incidental site activities permit, the site must be restored by the permittee within 90 days after notification by the District. Restoration must be completed by re-contouring the disturbed site to previous grades and slopes re-establishing and maintaining suitable vegetation and erosion control to provide stabilized hydraulic conditions. The period for completing restoration may be extended if requested by the permittee and determined by the District to be warranted due to adverse weather conditions or other good cause. In addition, the permittee shall institute stabilization measures for erosion and sediment control as soon as practicable, but in no case more than 7 days after notification by the District.

   b. The incidental site activities are commenced at the permittee's own risk. The Governing Board will not consider the monetary costs associated with the incidental site activities or any potential restoration costs in making its decision to approve or deny the individual environmental resource permit application. Issuance of this permit shall not in any way be construed as commitment to issue the associated individual environmental resource permit.

4. Activities approved by this permit shall be conducted in a manner which does not cause violations of state water quality standards. The permittee shall implement best management practices for erosion and a pollution control to prevent violation of state water quality standards. Temporary erosion control shall be implemented prior to and during construction, and permanent control measures shall be completed within 7 days of any construction activity. Turbidity barriers shall be installed and maintained at all locations where the possibility of transferring suspended solids into the receiving waterbody exists due to the permitted work. Turbidity barriers shall remain in place at all locations until construction is completed and soils are stabilized and vegetation has been established. Thereafter the permittee shall be responsible for the removal of the barriers. The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.

5. Water quality data for the water discharged from the permittee's property or into the surface waters of the state shall be submitted to the District as required by the permit. Analyses shall be performed according to procedures outlined in the current edition of Standard Methods for the Examination of Water and Wastewater by the American Public Health Association or Methods for Chemical Analyses of Water and Wastes by the U.S. Environmental Protection Agency. If water quality data are required, the permittee shall provide data as required on volumes of water discharged, including total volume discharged during the days of sampling and total monthly volume discharged from the property or into surface waters of the state.

6. District staff must be notified in advance of any proposed construction dewatering. If the dewatering activity is likely to result in offsite discharge or sediment transport into wetlands or surface waters, a written dewatering plan must either have been submitted and approved with the permit application or submitted to the District as a permit prior to the dewatering event as a permit modification. A water use permit may be required prior to any use exceeding the thresholds in Chapter 40D-2, F.A.C.

7. Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased.

8. Off-site discharges during construction and development shall be made only through the facilities authorized by this permit. Water discharged from the project shall be through structures having a mechanism suitable for regulating upstream stages. Stages may be subject to operating schedules satisfactory to the District.

9. The permittee shall complete construction of all aspects of the surface water management system, including wetland compensation (grading, mulching, planting), water quality treatment features, and discharge control facilities prior to beneficial occupancy or use of the development being served by this system.

10. The following shall be properly abandoned and/or removed in accordance with the applicable regulations:

    a. Any existing wells in the path of construction shall be properly plugged and abandoned by a licensed well contractor.
    b. Any existing septic tanks on site shall be abandoned at the beginning of construction.
    c. Any existing fuel storage tanks and fuel pumps shall be removed at the beginning of construction.

11. All surface water management systems shall be operated to conserve water in order to maintain environmental quality and resource protection; to increase the efficiency of transport, application and use; to decrease waste; to minimize unnatural runoff from the property and to minimize dewatering of offsite property.

12. At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the District a written notification of commencement indicating the actual start date and the expected completion date.

13. Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the occupation of the site or operation of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.

14. Within 30 days after completion of construction of the permitted activity, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing the required Statement of Completion and Request for Transfer to Operation Entity form identified in Chapter 40D-1, F.A.C. Additionally, if deviation from the approved drawings are discovered during the certification process the certification must be accompanied by a copy of the approved permit drawings with deviations noted.

15. This permit is valid only for the specific processes, operations and designs indicated on the approved drawings or exhibits submitted in support of the permit application. Any substantial deviation from the approved drawings, exhibits, specifications or permit conditions, including construction within the total land area but outside the approved project area(s), may constitute grounds for revocation or enforcement action by the District, unless a modification has been applied for and approved. Examples of substantial deviations include excavation of ponds, ditches or sump areas deeper than shown on the approved plans.

16. The operation phase of this permit shall not become effective until the permittee has complied with the requirements of the conditions herein, the District determines the system to be in compliance with the permitted plans, and the entity approved by the District accepts responsibility for operation and maintenance of the system. The permit may not be transferred to the operation and maintenance entity approved by the District until the operation phase of the permit becomes effective. Following inspection and approval of the permitted system by the District, the permittee shall request transfer of the permit to the responsible operation and maintenance entity approved by the District, if different from the permittee. Until a transfer is approved by the District, the permittee shall be liable for compliance with the terms of the permit.

17. Should any other regulatory agency require changes to the permitted system, the District shall be notified of the changes prior to implementation so that a determination can be made whether a permit modification is required.

18. This permit does not eliminate the necessity to obtain any required federal, state, local and special District authorizations including a determination of the proposed activities' compliance with the applicable comprehensive plan prior to the start of any activity approved by this permit.

19. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and Chapter 40D-4 or Chapter 40D-40, F.A.C.

20. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

21. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.

22. The permittee shall notify the District in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of Rule 40D-4.351, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.

23. Upon reasonable notice to the permittee, District authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with District rules, regulations and conditions of the permits.

24. If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the District and the Florida Department of State, Division of Historical Resources.

25. The permittee shall immediately notify the District in writing of any previously submitted information that is later discovered to be inaccurate.

Ash Engineering, Inc.

FEB 05 2010

Southwest Florida Water Management District

2379 Broad Street, Brooksville, Florida 34604-6899
(352) 796-7211 or 1-800-423-1476 (FL only)
SUNCOM 628-4150 TDD only 1-800-231-6103 (FL only)
On the Internet at: WaterMatters.org

An Equal Opportunity Employer

Bartow Service Office
170 Century Boulevard
Bartow, Florida 33830-7700
(863) 534-1448 or
1-800-492-7862 (FL only)
SUNCOM 572-6200

Lecanto Service Office
Suite 226
3600 West Sovereign Path
Lecanto, Florida 34461-8070
(352) 527-8131

Sarasota Service Office
6750 Fruitville Road
Sarasota, Florida 34240-9711
(941) 377-3722 or
1-800-320-3503 (FL only)
SUNCOM 531-6900

Tampa Service Office
7601 Highway 301 North
Tampa, Florida 33637-6759
(813) 985-7481 or
1-800-836-0797 (FL only)
SUNCOM 578-2070

NOTICING PACKET PUBLICATION INFORMATION

PLEASE SEE THE REVERSE SIDE OF THIS NOTICE FOR A LIST OF FREQUENTLY ASKED QUESTIONS (FAQ)

The District's action regarding the issuance or denial of a permit, a petition or qualification for an exemption only becomes closed to future legal challenges from members of the public ("third parties"), if 1.) "third parties" have been properly notified of the District's action regarding the permit or exemption, and 2.) no "third party" objects to the District's action within a specific period of time following the notification.

Notification of "third parties" is provided through publication of certain information in a newspaper of general circulation in the county or counties where the proposed activities are to occur. Publication of notice informs "third parties" of their right to challenge the District's action. If proper notice is provided by publication, "third parties" have a 21-day time limit in which to file a petition opposing the District's action. A shorter 14-day time limit applies to District action regarding Environmental Resource Permits linked with an authorization to use Sovereign Submerged Lands. However, if no notice to "third parties" is published, there is no time limit to a party's right to challenge the District's action. The District has not published a notice to "third parties" that it has taken or intends to take final action on your application. If you want to ensure that the period of time in which a petition opposing the District's action regarding your application is limited to the time frames stated above, you may publish, at your own expense, a notice in a newspaper of general circulation. A copy of the Notice of Agency Action the District uses for publication and guidelines for publishing are included in this packet.

Guidelines for Publishing a Notice of Agency Action

1. Prepare a notice for publication in the newspaper. The District's Notice of Agency Action, included with this packet, contains all of the information that is required for proper noticing. However, you are responsible for ensuring that the form and **the** content of your notice comply with the applicable statutory provisions.
2. Your notice must be published in accordance with Chapter 50, Florida Statutes. A copy of the statute is enclosed.
3. Select a newspaper that is appropriate considering the location of the activities proposed in your application, and contact the newspaper for further information regarding their procedures for publishing.
4. You only need to publish the notice for one day.
5. Obtain an "affidavit of publication" from the newspaper after your notice is published.
6. Immediately upon receipt send the **ORIGINAL** affidavit to the District at the address below, for the file of record. **Retain a copy of the affidavit for your records.**

Southwest Florida Water Management District
Records and Data Supervisor
2379 Broad Street
Brooksville, Florida 34604-6899

Note: If you are advertising a notice of the District's proposed action, and the District's final action is different, publication of an additional notice may be necessary to prevent future legal challenges. If you need additional assistance, please contact us at ext. 4360, at the Brooksville number listed above. **(Your question may be on the FAQ list)**.

FAQ ABOUT NOTICING

1. **Q.** Do I have to do this noticing, and what is this notice for?
   A. You do not have to do this noticing. You need to publish a notice if you want to ensure that a "third party" cannot challenge the District's action on your permit, exemption, or petition at some future date. If you choose not to publish, there is no time limit to a third party's right to challenge the District's action.

2. **Q.** What do I need to send to the newspaper?
   A. The enclosed one page notice form entitled "Notice of Final Agency Action (or Proposed Agency Action) By The Southwest Florida Water Management District." You must fill in the blanks before sending it.

3. **Q.** Do I have to use the notice form, or can I make up my own form?
   A. You do not have to use our form. However, your notice must contain all information that is in the form.

4. **Q.** Do I send the newspaper the whole form (one page) or just the top portion that has blanks?
   A. Send the full page form which includes the **NOTICE OF RIGHTS** section on the bottom half.

5. **Q.** Do I type or print the information in the blanks? Or will the newspaper fill in the blanks?
   A. You are required to fill in the blanks on the form before sending it to the newspaper. Contact your selected newspaper for instructions on printing or typing the information in the blanks.

6. **Q.** The section 50.051, F.S. (enclosed) proof of publication form of uniform affidavit has blanks in the text. Do I fill in these blanks and send that to the newspaper?
   A. No. That section shows the affidavit the newspaper will send you. They will fill in the blanks.

7. **Q.** If someone objects, is my permit or exemption no good?
   A. If you publish a notice and a "third party" files a request for administrative hearing within the allotted time, the matter is referred to an administrative hearing. While the case is pending, generally, you may not proceed with activities under the challenged agency action. When the hearing is complete, the administrative law judge's (ALJ) recommendation is returned to the District Governing Board, and the Governing Board will take final action on the ALJ's recommendation. There is no time limit for a "third party" to object and file a request for administrative hearing if you do not publish a notice.

8. **Q.** I don't understand what I should put in the blanks on the Notice form?
   A.
   1. **County, Section/Township/Range, application No., permit No., proposed permit No., petition No., Exemption No., or permit inquiry No.** is on your Permit, Petition, Exemption, or Denial document.
   2. **Permit Type or Application Type** is Environmental Resource Permit, Water Use Permit, Work of the District, etc.
   3. **# of Acres** is the project acres. This is listed on the Environmental Resource Permit documents. For Water Use Permits, Exemptions, etc., you may put "Not Applicable" if unknown.
   4. **Rule or Statute reference** (Exemptions only). The rule and/or statute reference is at the top of page one in the reference line of the Exemption. For all others, put "Not Applicable" in this blank.
   5. **Type of Project** describes your project activity. Environmental Resource Permit = Agriculture, Commercial, Government, Industrial, Mining, Road Projects, Residential, Semi-Public or Water Quality Treatment. Water Use Permit = Agricultural (if irrigating, state that it is irrigation and specify what is being irrigated), Industrial Commercial, Recreation Aesthetic, Mining Dewatering, or Public Supply. Work of the District = pipeline, etc.
   6. **Project Name** is the name of your project, if applicable. If there is no project name, put "Not Applicable" in this blank.

NOTICE OF FINAL AGENCY ACTION BY

THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Notice is given that the District's Final Agency Action is approval of the________________

on_______acres to serve_____________________________known as____________________.

The project is located in________________ County, Section(s)___________________,

Township________________South, Range________________East. The permit applicant

is__________________________whose address is______________________________.

The permit No. is ________________.

The file(s) pertaining to the project referred to above is available for inspection Monday through Friday except for legal holidays, 8:00 a.m. to 5:00 p.m., at the Southwest Florida Water Management District (District)____.

NOTICE OF RIGHTS

Any person whose substantial interests are affected by the District's action regarding this permit may request an administrative hearing in accordance with Sections 120.569 and 120.57, Florida Statutes (F.S.), and Chapter 28-106, Florida Administrative Code (F.A.C.), of the Uniform Rules of Procedure. *A request for hearing must (1) explain how the substantial interests of each person requesting the hearing will be affected by the District's action, or final action; (2) state all material facts disputed by each person requesting the hearing or state that there are no disputed facts; and (3) otherwise comply with Chapter 28-106, F.A.C.* A request for hearing must be filed with and received by the Agency Clerk of the District at the District's Brooksville address, 2379 Broad Street, Brooksville, FL 34604-6899 within 21 days of publication of this notice (or within14 days for an Environmental Resource Permit with Proprietary Authorization for the use of Sovereign Submerged Lands). Failure to file a request for hearing within this time period shall constitute a waiver of any right such person may have to request a hearing under Sections 120.569 and 120.57,F.S.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the District's final action may be different from the position taken by it in this notice of final agency action. Persons whose substantial interests will be affected by any such final decision of the District on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation pursuant to Section 120.573, F.S., to settle an administrative dispute regarding the District's final action in this matter is not available prior to the filing of a request for hearing.

CHAPTER 50, FLORIDA STATUTES

LEGAL AND OFFICIAL ADVERTISEMENTS

50.011 Where and in what language legal notices to be published.¥

Whenever by statute an official or legal advertisement or a publication, or notice in a newspaper has been or is directed or permitted in the nature of or in lieu of process, or for constructive service, or in initiating, assuming, reviewing, exercising or enforcing jurisdiction or power, or for any purpose, including all legal notices and advertisements of sheriffs and tax collectors, the contemporaneous and continuous intent and meaning of such legislation all and singular, existing or repealed, is and has been and is hereby declared to be and to have been, and the rule of interpretation is and has been, a publication in a newspaper printed and published periodically once a week or oftener, containing at least 25 percent of its words in the English language, entered or qualified to be admitted and entered as [1]second-class matter at a post office in the county where published, for sale to the public generally, available to the public generally for the publication of official or other notices and customarily containing information of a public character or of interest or of value to the residents or owners of property in the county where published, or of interest or of value to the general public.

History.-s. 2, ch. 3022, 1877; RS 1296; GS 1727; s. 1, ch. 5610, 1907; RGS 2942; s. 1, ch. 12104, 1927; CGL 4666, 4901; s. 1, ch. 63-387; s. 6, ch. 67-254.

[1]**Note.**-Redesignated as "Periodicals" by the United States Postal Service, *see* 61 F.R. 10123-10124, March 12, 1996.

Note.-Former s. 49.01.

50.021 Publication when no newspaper in county.-

When any law, or order or decree of court, shall direct advertisements to be made in any county and there be no newspaper published in the said county, the advertisement may be made by posting three copies thereof in three different places in said county, one of which shall be at the front door of the courthouse, and by publication in the nearest county in which a newspaper is published.

History.-RS 1297; GS 1728; RGS 2943; CGL 4667; s. 6, ch. 67-254.

Note.-Former s. 49.02.

50.031 Newspapers in which legal notices and process may be published.-

No notice or publication required to be published in a newspaper in the nature of or in lieu of process of any kind, nature, character or description provided for under any law of the state, whether heretofore or hereafter enacted, and whether pertaining to constructive service, or the initiating, assuming, reviewing, exercising or enforcing jurisdiction or power, by any court in this state, or any notice of sale of property, real or personal, for taxes, state, county or municipal, or sheriff's, guardian's or administrator's or any sale made pursuant to any judicial order, decree or statute or any other publication or notice pertaining to any affairs of the state, or any county, municipality or other political subdivision thereof, shall be deemed to have been published in accordance with the statutes providing for such publication, unless the same shall have been published for the prescribed period of time required for such publication, in a newspaper which at the time of such publication shall have been in existence for 1 year and shall have been entered as [1]second-class mail matter at a post office in the county where published, or in a newspaper which is a direct successor of a newspaper which together have been so published; provided, however, that nothing herein contained shall apply where in any county there shall be no newspaper in existence which shall have been published for the length of time above prescribed. No legal publication of any kind, nature or description, as herein defined, shall be valid or binding or held to be in compliance with the statutes providing for such publication unless the same shall have been published in accordance with the provisions of this section. Proof of such publication shall be made by uniform affidavit.

History.-ss. 1-3, ch. 14830, 1931; CGL 1936 Supp. 4274(1); s. 7, ch. 22858, 1945; s. 6, ch. 67-254; s. 1, ch. 74-221.

[1]**Note.**-Redesignated as "Periodicals" by the United States Postal Service, *see* 61 F.R. 10123-10124, March 12, 1996.

Note.¥Former s. 49.03.

50.041 Proof of publication; uniform affidavits required.-

(1) All affidavits of publishers of newspapers (or their official representatives) made for the purpose of establishing proof of publication of public notices or legal advertisements shall be uniform throughout the state.

(2) Each such affidavit shall be printed upon white bond paper containing at least 25 percent rag material and shall be 8½ inches in width and of convenient length, not less than 5½ inches. A white margin of not less than 2½ inches shall be left at the right side of each affidavit form and upon or in this space shall be substantially pasted a clipping which shall be a true copy of the public notice or legal advertisement for which proof is executed.

(3) In all counties having a population in excess of 450,000 according to the latest official decennial census, in addition to the charges which are now or may hereafter be established by law for the publication of every official notice or legal advertisement, there may be a charge not to exceed $2 for the preparation and execution of each such proof of publication or publisher's affidavit.

History.¥s. 1, ch. 19290, 1939; CGL 1940 Supp. 4668(1); s. 1, ch. 63-49; s. 26, ch. 67-254; s. 1, ch. 76-58.

Note.¥Former s. 49.04.

50.051 Proof of publication; form of uniform affidavit.¥

The printed form upon which all such affidavits establishing proof of publication are to be executed shall be substantially as follows:

NAME OF NEWSPAPER
Published (Weekly or Daily)
(Town or City) (County) FLORIDA

STATE OF FLORIDA
COUNTY OF ________:

Before the undersigned authority personally appeared ________, who on oath says that he or she is ________ of the ________, a ________ newspaper published at ________ in ________ County, Florida; that the attached copy of advertisement, being a ________ in the matter of ________ in the ________ Court, was published in said newspaper in the issues of ________.

Affiant further says that the said ________ is a newspaper published at ________, in said ________ County, Florida, and that the said newspaper has heretofore been continuously published in said ________ County, Florida, each ________ and has been entered as [1]second-class mail matter at the post office in ________, in said ________ County, Florida, for a period of 1 year next preceding the first publication of the attached copy of advertisement; and affiant further says that he or she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper. Sworn to and subscribed before me this ________ day of ________, 19__, by ________, who is personally known to me or who has produced (type of identification) as identification.

____(Signature of Notary Public)____

____(Print, Type, or Stamp Commissioned Name of Notary Public)____

____(Notary Public)____

History.-s. 2, ch. 19290, 1939; CGL 1940 Supp. 4668(2); s. 6, ch. 67-254; s. 1, ch. 93-62; s. 291, ch. 95-147.

[1]**Note.**¥Redesignated as "Periodicals" by the United States Postal Service, *see* 61 F.R. 10123-10124, March 12, 1996.

Note.-Former s. 49.05.

50.061 Amounts chargeable.¥

(1) The publisher of any newspaper publishing any and all official public notices or legal advertisements shall charge therefore the rates specified in this section without rebate, commission or refund.

(2) The charge for publishing each such official public notice or legal advertisement shall be 70 cents per square inch for the first insertion and 40 cents per square inch for each subsequent insertion, except that:

(a) In all counties having a population of more than 304,000 according to the latest official decennial census, the charge for publishing each such official public notice or legal advertisement shall be 80 cents per square inch for the first insertion and 60 cents per square inch for each subsequent insertion.

(b) In all counties having a population of more than 450,000 according to the latest official decennial census, the charge for publishing each such official public notice or legal advertisement shall be 95 cents per square inch for the first insertion and 75 cents per square inch for each subsequent insertion.

(3) Where the regular established minimum commercial rate per square inch of the newspaper publishing such official public notices or legal advertisements is in excess of the rate herein stipulated, said minimum commercial rate per square inch may be charged for all such legal advertisements or official public notices for each insertion, except that a governmental agency publishing an official public notice or legal advertisement may procure publication by soliciting and accepting written bids from newspapers published in the county, in which case the specified charges in this section do not apply.

(4) All official public notices and legal advertisements shall be charged and paid for on the basis of 6-point type on 6-point body, unless otherwise specified by statute.

(5) Any person violating a provision of this section, either by allowing or accepting any rebate, commission, or refund, commits a misdemeanor of the second degree, punishable as provided in s. 775.082 or s. 775.083.

(6) Failure to charge the rates prescribed by this section shall in no way affect the validity of any official public notice or legal advertisement and shall not subject same to legal attack upon such grounds.

History.-s. 3, ch. 3022, 1877; RS 1298; GS 1729; RGS 2944; s. 1, ch. 12215, 1927; CGL 4668; ss. 1, 2, 2A, 2B, ch. 20264, 1941; s. 1, ch. 23663, 1947; s. 1, ch. 57-160; s. 1, ch. 63-50; s. 1, ch. 65-569; s. 6, ch. 67-254; s. 15, ch. 71-136; s. 35, ch. 73-332; s. 1, ch. 90-279.

Note.¥Former s. 49.06.

50.071 Publication costs; court docket fund.¥

(1) There is established in Broward, Dade, and Duval Counties a court docket fund for the purpose of paying the cost of the publication of the fact of the filing of any civil case in the circuit court in those counties by their counties by their style and of the calendar relating to such cases. A newspaper qualified under the terms of s. 50.011 shall be designated as the record newspaper for such publication by an order of a majority of the judges in the judicial circuit in which the subject county is located and such order shall be filed and recorded with the clerk of the circuit court for the subject county. The court docket fund shall be funded by a service charge of $1 added to the filing fee for all civil actions, suits, or proceedings filed in the circuit court of the subject county. The clerk of the circuit court shall maintain such funds separate and apart, and the aforesaid fee shall not be diverted to any other fund or for any purpose other than that established herein. The clerk of the circuit court shall dispense the fund to the designated record newspaper in the county on a quarterly basis. The designated record newspaper may be changed at the end of any fiscal year of the county by a majority vote of the judges of the judicial circuit of the county so ordering 30 days prior to the end of the fiscal year, notice of which order shall be given to the previously designated record newspaper.

(2) The board of county commissioners or comparable or substituted authority of any county in which a court docket fund is not specifically established in subsection (1) may, by local ordinance, create such a court docket fund on the same terms and conditions as established in subsection (1).

(3) The publishers of any designated record newspapers receiving the court docket fund established in subsection (1) shall, without charge, accept legal advertisement for the purpose of service of process by publication under s. 49.011(4), (10), and (11) when such publication is required of persons authorized to proceed as insolvent and poverty-stricken persons under s. 57.081.

History.-s. 1, ch. 75-206.

PART II HEARINGS INVOLVING DISPUTED ISSUES OF MATERIAL FACT

28-106.201 Initiation of Proceedings.

(1) Unless otherwise provided by statute, initiation of proceedings shall be made by written petition to the agency responsible for rendering final agency action. The term "petition" includes any document that requests an evidentiary proceeding and asserts the existence of a disputed issue of material fact. Each petition shall be legible and on 8 ½ by 11 inch white paper. Unless printed, the impression shall be on one side of the paper only and lines shall be double-spaced.

(2) All petitions filed under these rules shall contain:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;

(c) A statement of when and how the petitioner received notice of the agency decision;

(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;

(e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the agency's proposed action;

(f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the agency's proposed action; and

(g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the agency to take with respect to the agency's proposed action.

(3) Upon receipt of a petition involving disputed issues of material fact, the agency shall grant or deny the petition, and if granted shall, unless otherwise provided by law, refer the matter to the Division of Administrative Hearings with a request that an administrative law judge be assigned to conduct the hearing. The request shall be accompanied by a copy of the petition and a copy of the notice of agency action.

(4) A petition shall be dismissed if it is not in substantial compliance with subsection (2) of this rule or it has been untimely filed. Dismissal of a petition shall, at least once, be without prejudice to petitioner's filing a timely amended petition curing the defect, unless it conclusively appears from the face of the petition that the defect cannot be cured.

(5) The agency shall promptly give written notice to all parties of the action taken on the petition, shall state with particularity its reasons if the petition is not granted, and shall state the deadline for filing an amended petition if applicable.

Specific Authority 120.54(3), (5) F.S. Law Implemented 120.54(5), 120.569, 120.57 F.S. History–New 4-1-97, Amended 9-17-98.

PART III PROCEEDINGS AND HEARINGS NOT INVOLVING DISPUTED ISSUES OF MATERIAL FACT

28-106.301 Initiation of Proceedings

(1) Initiation of a proceeding shall be made by written petition to the agency responsible for rendering final agency action. The term "petition" includes any document which requests a proceeding. Each petition shall be legible and on 8 ½ by 11 inch white paper or on a form provided by the agency. Unless printed, the impression shall be on one side of the paper only and lines shall be double-spaced.

(2) All petitions filed under these rules shall contain:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination;

(c) A statement of when and how the petitioner received notice of the agency decision;

(d) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the agency's proposed action;

(e) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the agency's proposed action; and

(f) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the agency to take with respect to the agency's proposed action.

(3) If the petition does not set forth disputed issues of material fact, the agency shall refer the matter to the presiding officer designated by the agency with a request that the matter be scheduled for a proceeding not involving disputed issues of material fact. The request shall be accompanied by a copy of the petition and a copy of the notice of agency action.

(4) A petition shall be dismissed if it is not in substantial compliance with subsection (2) of this Rule or it has been untimely filed. Dismissal of a petition shall, at least once, be without prejudice to petitioner's filing a timely amended petition curing the defect, unless it conclusively appears from the face of the petition that the defect cannot be cured.

(5) The agency shall promptly give written notice to all parties of the action taken on the petition, shall state with particularity its reasons if the petition is not granted, and shall state the deadline for filing an amended petition if applicable.

Specific Authority 120.54(5) F.S. Law Implemented 120.54(5), 120.569, 120.57 F.S. History–New 4-1-97, Amended 9-17-98.

APPENDIX C

CONSISTENCY STATEMENT

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APPENDIX C

CONSISTENCY STATEMENT

This consistency statement will examine the potential environmental consequences of the Proposed Action and ascertain the extent to which the consequences of the Proposed Action are consistent with the objectives of Florida Coastal Management Program (CMP).

Of the Florida Statutory Authorities included in the CMP, impacts in the following areas are addressed in the EA: beach and shore preservation (Chapter 161), historic preservation (Chapter 267), economic development and tourism (Chapter 288), public transportation (Chapters 334 and 339), saltwater living resources (Chapter 370), living land and freshwater resource (Chapter 372), water resources (Chapter 373), environmental control (Chapter 403), and soil and water conservation (Chapter 582). This consistency statement discusses how the proposed options may meet the CMP objectives.

CONSISTENCY DETERMINATION

Chapter 161: Beach and Shore Preservation

No disturbances to the base's canals are foreseen under the Proposed Action or Alternative Actions.

Chapter 267: Historic Preservation

The Air Force and the Florida State Historic Preservation Officer have determined that the Proposed Action would have no effect on historic properties associated with the Base.

Chapter 288: Economic Development and Tourism

The EA presents the new employment impact and net income impact of the Proposed Action and alternative. The options would not have significant adverse effects on any key Florida industries or economic diversification efforts.

Chapter 372: Saltwater Living Resources

The EA addresses potential impacts to local water bodies. Water quality impacts were surveyed for existing conditions at the Proposed Action and alternatives. Results indicate that no impacts would result from the Proposed Action or alternatives.

Chapter 372: Living Land and Freshwater Resources

Threatened and endangered species, major plant communities, conservation of native habitat, and mitigation of potential impacts to the resources are addressed in the EA. The Proposed Action and alternatives would not result in permanent disturbance to native habitat and should not impact threatened or endangered species.

Chapter 373: Water Resources

There would be no impacts to surface water or groundwater quality under the Proposed Action or alternatives as discussed in the EA.

Chapter 403: Environmental Control

The EA addresses the issues of conservation and protection of environmentally sensitive living resources; protection of groundwater and surface water quality and quantity; potable water supply; protection of air quality; minimization of adverse hydrogeologic impacts; protection of endangered or threatened species; solid, sanitary, and hazardous waste disposal; and protection of floodplains and wetlands. Where impacts to these resources can be identified, possible mitigation measures are suggested. Implementation of mitigation would be, for the most part, the responsibility of MacDill AFB.

Chapter 582: Soil and Water Conservation

The EA addresses the potential of the Proposed Action and alternatives to disturb soil and presents possible measures to prevent or minimize soil erosion. Impacts to groundwater and surface water resources also are discussed in the EA.

CONCLUSION

The Air Force finds that the conceptual Proposed Action and alternatives plans presented in the EA are consistent with Florida's CMP.

APPENDIX D

PROPOSED AIRFIELD DRAINAGE IMPROVEMENT SITE PHOTOGRAPHS

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Photo #1: View of Airfield Drainage Improvement Area, west of Runway L.

Photo #2: View of the Airfield Drainage Improvement Area, west of Runway L.

Photo #3: View of the Airfield Drainage Improvement Area, along North Boundary Road.

Photo #4: View of the Airfield Drainage Improvement Area, along North Boundary Road.

Photo #5: View of the Airfield Drainage Improvement Area, east of Taxiway G.

Photo #6: View of the Airfield Drainage Improvement Area, east of Taxiway G.

Photo #7: View of the Airfield Drainage Improvement Area, approach to runway.

Photo #8: View of the Airfield Drainage Improvement Area southwest end of runway.

Photo #9: View of the Airfield Drainage Improvement Area, east of tower.

Photo #10: View of the Airfield Drainage Improvement Area, east of tower.

Photo #11: View of the Airfield Drainage Improvement Area, along North Boundary Road.

Photo #12: View of the Rattlesnake Creek visible along North Perimeter Road.

APPENDIX E

AIR EMISSION CALCULATIONS FOR PROPOSED ACTION AND CUMULATIVE AIR EMISSIONS

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Summary Summarizes total emissions for each project by calendar year

Combustion Estimates emissions from non-road equipment exhaust as well as painting

Fugitive Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust

Grading Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions

Tier Report Summarizes total emissions for Hillsborough County, FL for 2002, to be used to compare project to county emissions.

Air Quality Emissions from Total Proposed Action Projects

Construction Emissions from Proposed Action	NO_x (tpy)	VOC (tpy)	CO (tpy)	SOx (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Airfield Drainage Improvements - Wetland Impacts	0.50	0.03	0.19	0.01	11.82	1.21
Airfield Drainage Improvements - Grading/Filling	1.46	0.09	0.55	0.03	25.97	2.67
Replace Rattlesnake Creek Box Culvert	0.10	0.01	0.04	0.00	0.05	0.01
Wetland Mitigation	0.37	0.02	0.14	0.01	8.58	0.88
TOTAL	**2.43**	**0.15**	**0.92**	**0.05**	**46.43**	**4.77**

Since future year budgets were not readily available, actual 2002 air emissions inventories for the county was used as an approximation of the regional inventory. Because the Proposed Action is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Hillsborough County

Point and Area Sources Combined						
Year	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
2002	58,191	34,880	6,517	65,890	22,379	7,221

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 28 June 2010.

Determination Significance (Significance Threshold = 10%) for Proposed Activities

	Point and Area Sources Combined					
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Hillsborough County Emissions	58,191	34,880	6,517	65,890	22,379	7,221
10% of Hills. County Emissions	5,819	3,488	652	6,589	2,238	722
Proposed Action Emissions	2.430	0.150	0.919	0.049	46.425	4.773
Proposed Action %	**0.004%**	**0.000%**	**0.014%**	**0.000%**	**0.207%**	**0.066%**
Regionally Significant?	**no**	**no**	**no**	**no**	**no**	**no**

Airfield Drainage Improvements - Wetland Impacts
Project Summary

Includes:

1 100% of Airfield Drainage Improvements - Wetland Impacts (13.79 ac) 600,692 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	901,038	ft^2	Airfield Drainage Improvement Projects could disturb more than the project area. If so, cell "C14" sh
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.50	0.03	0.19	0.01	0.03	0.03
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	11.79	1.18
Total Project Emissions (tpy)	**0.500**	**0.031**	**0.189**	**0.010**	**11.821**	**1.209**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0009%	0.00009%	0.00289%	0.000015%	0.0528%	0.0167%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	2	83.282	5.154	31.420	1.666	5.091	4.938
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	901,038	20.68	12	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	999.39	61.85	377.04	19.99	61.09	59.26
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	999.39	61.85	377.04	19.99	61.09	59.26

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**999.39**	**61.85**	**377.04**	**19.99**	**61.09**	**59.26**
Total Project Combustion Emissions (tons)	**0.4997**	**0.0309**	**0.1885**	**0.0100**	**0.0305**	**0.0296**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	20.7	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	23.58	11.79	1.18	0.59
Total	**23.58**	**11.79**	**1.18**	**0.59**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 20.68 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	20.68	2.59
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	20.68	10.11
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	10.34	10.43
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	10.34	4.28
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	20.68	7.25
TOTAL								34.66

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	34.66
Qty Equipment:	3.00
Grading days/yr:	**11.55**

Airfield Drainage Improvements - Grading/Filling
Project Summary

Includes:

1 100% of Airfield Drainage Improvements - Grading/Filling (30.27 ac) 1,318,506 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0 ft^2	
Total Demolished Area:	0 ft^2	If project includes any demolition, include here
Total Paved Area:	0 ft^2	
Total Disturbed Area:	1,977,759 ft^2	Airfield Drainage Improvement Projects could disturb more than the project area. If so, cell "C14" sh
Construction Duration:	0.5 year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0 months	
Annual Construction Activity:	115 days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	1.46	0.09	0.55	0.03	0.09	0.09
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	25.88	2.59
Total Project Emissions (tpy)	**1.46**	**0.09**	**0.55**	**0.03**	**25.97**	**2.67**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0025%	0.00026%	0.00844%	0.000044%	0.1160%	0.0370%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	5	208.206	12.885	78.549	4.164	12.728	12.346
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	1,977,759	45.40	14	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	2,914.89	180.39	1,099.69	58.30	178.19	172.84
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	2,914.89	180.39	1,099.69	58.30	178.19	172.84

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**2,914.89**	**180.39**	**1,099.69**	**58.30**	**178.19**	**172.84**
Total Project Combustion Emissions (tons)	**1.4574**	**0.0902**	**0.5498**	**0.0291**	**0.0891**	**0.0864**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	45.4	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	51.76	25.88	2.59	1.29
Total	**51.76**	**25.88**	**2.59**	**1.29**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 45.40 acres/yr (from "COMBUSTION" above)

Qty Equipment: **5.45** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	45.40	5.68
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	45.40	22.20
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	22.70	22.89
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	22.70	9.39
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	45.40	15.92
TOTAL								76.08

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	76.08
Qty Equipment:	5.45
Grading days/yr:	**13.96**

Replace Rattlesnake Road Box Culvert
Project Summary

Includes:

1 100% of Replace Rattlesnake Road Box Culvert 3,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	3,000	ft^2	If project includes any demolition, include here
Total Paved Area:	3,000	ft^2	
Total Disturbed Area:	6,000	ft^2	Airfield Drainage Improvement Projects could disturb more than the paved area. If so, cell "C14" sho
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.6	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.10	0.01	0.04	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.05	0.01
Total Project Emissions (tpy)	**0.098**	**0.006**	**0.039**	**0.002**	**0.054**	**0.011**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00060%	0.000003%	0.0002%	0.0002%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	6,000	0.14	1	(from "GRADING" below)
Paving:	3,000	0.07	1	
Demolition:	3,000	0.07	3	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	45.37	2.61	18.58	0.91	2.78	2.69
Demolition	109.53	6.49	43.33	2.19	6.62	6.42
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	196.54	11.68	77.62	3.93	11.94	11.59

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**196.54**	**11.68**	**77.62**	**3.93**	**11.94**	**11.59**
Total Project Combustion Emissions (tons)	**0.0983**	**0.0058**	**0.0388**	**0.0020**	**0.0060**	**0.0058**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency	0.50	EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)		

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	1	months
Area	0.1	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.02	0.01	0.00	0.00
General Construction Activities	0.08	0.04	0.00	0.00
Total	**0.10**	**0.05**	**0.01**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.14 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.14	0.02
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.14	0.07
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.07	0.07
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.07	0.03
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.14	0.05
TOTAL								0.23

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.23
Qty Equipment: 3.00
Grading days/yr: **0.08**

Wetland Mitigation
Project Summary

Includes:

1 100% of Construct New Wetlands (10.01 ac) 436,036 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	654,054	ft^2	Airfield Drainage Improvement Projects could disturb more than the wetlands area. If so, cell "C14" s
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.37	0.02	0.14	0.01	0.02	0.02
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	8.56	0.86
Total Project Emissions (tpy)	**0.375**	**0.023**	**0.141**	**0.007**	**8.581**	**0.878**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0006%	0.00007%	0.00217%	0.000011%	0.0383%	0.0122%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	2	83.282	5.154	31.420	1.666	5.091	4.938
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	654,054	15.02	9	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	749.54	46.39	282.78	14.99	45.82	44.44
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	749.54	46.39	282.78	14.99	45.82	44.44

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**749.54**	**46.39**	**282.78**	**14.99**	**45.82**	**44.44**
Total Project Combustion Emissions (tons)	**0.3748**	**0.0232**	**0.1414**	**0.0075**	**0.0229**	**0.0222**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	15.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	17.12	8.56	0.86	0.43
Total	**17.12**	**8.56**	**0.86**	**0.43**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 15.02 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	15.02	1.88
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	15.02	7.34
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	7.51	7.57
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	7.51	3.11
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	15.02	5.27
TOTAL								25.16

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 25.16
Qty Equipment: 3.00
Grading days/yr: **8.39**

* US EPA - AirData Emissions by Category Report - Criteria Air Pollutants, http://www.epa.gov/air/data/geosel.html
* Monday, 13-Jul-2009 at 1:59:26 PM (USA Eastern time zone)
* Geographic Area: Hillsborough Co, FL
* Pollutant: Carbon Monoxide, Nitrogen Oxides, Particles < 10 micrometers diameter, Particles < 2.5 micrometers diameter, Sulfur Dioxide, Volatile Organic Compounds
* Year: 2002
*
* Pollutant Emissions In Tons Per Year
*

			Point Source Emissions						Nonpoint+Mobile Source Emissions					
State	**County**	**Tier I**	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**
FL	Hillsborough Co	01-Fuel Comb. Elec. Util.	1727	55765	6349	4918	64629	190	0	0	0	0	0	0
FL	Hillsborough Co	02-Fuel Comb. Industrial	150	296	18.1	14.2	15.4	13.6	467	984	9.46	6.39	72.4	29.3
FL	Hillsborough Co	03-Fuel Comb. Other	18.6	59	4.66	4.29	3.54	4.67	1846	788	304	289	501	696
FL	Hillsborough Co	04-Chemical & Allied Product Mfg	0	185	183	58.8	0	2.81	0	0	0	0	0	407
FL	Hillsborough Co	05-Metals Processing	790	1.44	45.4	15.4	577	33.6	0	0	0	0	0	0
FL	Hillsborough Co	06-Petroleum & Related Industries	72.6	19.5	35.5	20.3	20.5	26.3	0	0	0	0	0	0
FL	Hillsborough Co	07-Other Industrial Processes	74.6	17.6	368	136	46.8	131	129	0	544	371	0	347
FL	Hillsborough Co	08-Solvent Utilization	0.28	1.11	16.3	5.93	0	646	0	0	0	0	0	20032
FL	Hillsborough Co	09-Storage & Transport	42.1	13.9	387	125	0.44	493	0	0	0	0	0	11391
FL	Hillsborough Co	10-Waste Disposal & Recycling	23.8	31.4	27.3	19.8	1.01	12.4	48.5	14.6	13	9.23	9.18	174
FL	Hillsborough Co	14-Miscellaneous	0	0	0	0	0	0	1128	14.1	14074	1228	13.3	250
FL	Hillsborough Co	11-Highway Vehicles	0	0	0	0	0	0	228413	25546	706	506	1283	22321
FL	Hillsborough Co	12-Off-Highway	0	0	0	0	0	0	94881	21593	1291	1243	2597	8341
		TOTAL	2,899	56,390	7,434	5,318	65,294	1,553	326,913	48,940	16,941	3,653	4,476	63,988

Criteria Air Pollutant	**CO (tpy)**	**NO_x (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**	**SO2 (tpy)**	**VOC (tpy)**	**Pb (tpy)**
Point Sources	2,899	56,390	7,434	5,318	65,294	1,553	-
Area Sources	3,619	1,801	14,944	1,904	596	33,326	-
Stationary Total	**6,517**	**58,191**	**22,379**	**7,221**	**65,890**	**34,880**	
On-road Mobile	228,413	25,546	706	506	1,283	22,321	-
Non-road Mobile	94,881	21,593	1,291	1,243	2,597	8,341	-
Mobile Total	**323,294**	**47,139**	**1,997**	**1,749**	**3,880**	**30,662**	
Grand Total	**329,811**	**105,330**	**24,376**	**8,970**	**69,770**	**65,542**	**4.46**

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Summary	Summarizes total emissions by calendar year for cumulative projects.
Projects Included	Summarizes construction and demolition projects included for cumulative analysis
Combustion	Estimates emissions from non-road equipment exhaust as well as painting
Fugitive	Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissioi
Tier Report	Summarizes total emissions for Hillsborough County, FL for 2002, to be used to compare project to county emissions.

Air Quality Emissions from Total Cumulative Construction Projects

	NO_x	VOC	CO	SOx	PM_{10}	$PM_{2.5}$
Construction Emissions from Cumulative Projects	**(typ)**	**(typ)**	**(typ)**	**(typ)**	**(typ)**	**(typ)**
New CENTCOM Construction and Demolition	4.74	0.75	2.08	0.36	9.31	1.26
Consolidated Communication Facility Construction	2.32	0.33	1.02	0.18	0.76	0.22
Consolidated Communication Fac - Demo Bldg 265	0.09	0.01	0.04	0.00	0.04	0.01
JCSE Ops Facility Construction	2.34	0.41	1.03	0.18	1.66	0.31
JCSE Ops Facility -Demo Bldg 89	0.35	0.02	0.14	0.01	0.16	0.04
JCSE Ops Facility -Demo Bldg 848	0.06	0.00	0.03	0.00	0.02	0.01
JCSE Ops Facility -Demo Bldg 860	0.03	0.00	0.01	0.00	0.00	0.00
JCSE Ops Facility -Demo Bldg 861	1.23	0.07	0.48	0.02	0.58	0.12
JCSE Ops Facility -Demo Bldg 886	0.05	0.00	0.02	0.00	0.02	0.00
JCSE Ops Facility -Demo Temp DJC2	0.20	0.01	0.08	0.00	0.09	0.02
MacDill Gate	0.34	0.02	0.13	0.01	0.34	0.08
JCSE Paint Facility	2.32	0.24	1.02	0.18	0.26	0.17
CENTCOM Parking Garage Construction	4.67	1.00	2.05	0.36	9.54	1.24
CENTCOM Parking - Demo Bldg 1051	0.23	0.01	0.09	0.00	0.10	0.02
CENTCOM Parking - Demo Bldg 1053	0.13	0.01	0.05	0.00	0.06	0.01
Warehouse Complex	4.70	0.53	2.07	0.36	9.66	1.30
Logistics Readiness Complex	5.08	0.61	2.22	0.37	5.01	1.16
SOCCENT HQ	5.03	0.64	2.20	0.37	12.07	1.75
New CATM	4.72	0.44	2.08	0.36	0.97	0.44
New CDC	4.70	0.52	2.07	0.36	5.43	0.87
120 Room Dorm	4.63	0.52	2.04	0.36	1.88	0.49
Mission Support - Demo Building 1066	0.09	0.01	0.04	0.00	0.04	0.01
Mission Support - Demo Building 373	0.53	0.03	0.21	0.01	0.25	0.05
JCSE Squadron Facility	4.68	0.60	2.06	0.36	1.80	0.52
Building 53 Consolidation - Demo Bldg 297	0.19	0.01	0.07	0.00	0.08	0.02
Building 53 Consolidaiton - Demo Bldg 258 & 2020	0.52	0.03	0.21	0.01	0.25	0.05
Building 500 Demolition	0.65	0.04	0.26	0.01	0.31	0.07
Building 510 Demolition	0.04	0.00	0.02	0.00	0.01	0.00
Building 119 Demolition	0.04	0.00	0.02	0.00	0.01	0.00
Building 317 Demolition	0.08	0.00	0.03	0.00	0.03	0.01
Building 397 Demolition	0.58	0.03	0.23	0.01	0.28	0.06
Building 398 Demolition	0.07	0.00	0.03	0.00	0.02	0.01
Building 540 Demolition	3.50	0.21	1.38	0.07	3.89	0.57
Building 541 Demolition	0.06	0.00	0.02	0.00	0.02	0.01
Building 543 Demolition	0.08	0.00	0.03	0.00	0.03	0.01
Building 178 Demolition	0.05	0.00	0.02	0.00	0.02	0.00
Building 3176 Demolition	0.02	0.00	0.01	0.00	0.00	0.00
Building 3500 Demolition	0.02	0.00	0.01	0.00	0.00	0.00
Eliminate CENTOM Avenue	0.13	0.01	0.05	0.00	0.13	0.02
Extend SOCOM Memorial Drive	0.07	0.00	0.03	0.00	0.41	0.07
Eliminate Intersection at Tampa Point and Bayshore	0.04	0.00	0.02	0.00	0.02	0.00
Extend Zemke Avenue	0.04	0.00	0.02	0.00	0.25	0.05
Widen South Boundary Boulevard	0.04	0.00	0.02	0.00	0.36	0.06
Extend Great Egret Street	0.09	0.01	0.04	0.00	1.01	0.18
Construct Parking Lot	0.07	0.00	0.03	0.00	0.42	0.07
Relocate Aircraft Wash Rack	0.11	0.01	0.05	0.00	1.17	0.34
Other Potential Roadway Improvement Projects	0.09	0.01	0.04	0.00	1.21	0.28
Total Cumulative Emissions	**59.86**	**7.18**	**25.87**	**4.01**	**69.97**	**11.99**

Since future year budgets were not readily available, actual 2002 air emissions inventories for the county was used as an approximation of the regional inventory. Because the Proposed Action is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Hillsborough County

Point and Area Sources Combined						
Year	**NO_x (tpy)**	**VOC (tpy)**	**CO (tpy)**	**SO_2 (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**
2002	58,191	34,880	6,517	65,890	22,379	7,221

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 28 June 2010.

Determination Significance (Significance Threshold = 10% or above De minimus values) for Construction Activities

	Point and Area Sources Combined					
	NO_x (tpy)	**VOC (tpy)**	**CO (tpy)**	**SO_2 (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**
Hillsborough County Emissions	58,191	34,880	6,517	65,890	22,379	7,221
10% of Hills. County Emissions	5,819	3,488	652	6,589	2,238	722
Cumulative Emissions	59.856	7.178	25.866	4.009	69.967	11.985
Cumulative Construction %	**0.103%**	**0.021%**	**0.397%**	**0.006%**	**0.313%**	**0.166%**
Regionally Significant?	**no**	**no**	**no**	**no**	**no**	**no**

Construction Consolidated Communications Facility
Project Summary

Includes:

1 100% of Construction Communications Facility 30,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	30,000	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	45,000	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	2.32	0.33	1.02	0.18	0.17	0.16
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.59	0.06
Total Project Emissions (tpy)	**2.322**	**0.326**	**1.023**	**0.180**	**0.756**	**0.221**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0040%	0.00094%	0.01570%	0.000274%	0.0034%	0.0031%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.
d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			14.116				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	45,000	1.03	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	30,000	0.69	115	
Architectural Coating	30,000	0.69	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	4,530.58	359.93	1,998.97	358.38	325.34	315.58
Architectural Coatings	71.48	289.79	31.31	1.43	6.19	6.00
Total Emissions (lbs):	4,643.70	652.29	2,045.98	360.64	334.07	324.05

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**4,643.70**	**652.29**	**2,045.98**	**360.64**	**334.07**	**324.05**
Total Project Combustion Emissions (tons)	**2.3218**	**0.3261**	**1.0230**	**0.1803**	**0.1670**	**0.1620**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency	0.50		EPA 2001; EPA 2006

(assume 50% control efficiency for PM10 and PM2.5 emissions)

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	1.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	1.18	0.59	0.06	0.03
Total	**1.18**	**0.59**	**0.06**	**0.03**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.03 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.03	0.13
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.03	0.51
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.52	0.52
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.52	0.21
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.03	0.36
TOTAL								1.73

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1.73
Qty Equipment: 3.00
Grading days/yr: **0.58**

Demolish Building 265
Project Summary

Includes:

1 100% of Demolition Building 265 4,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0 ft^2	
Total Demolished Area:	4,000 ft^2	If project includes any demolition, include here
Total Paved Area:	0 ft^2	
Total Disturbed Area:	6,000 ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2 year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0 months	
Annual Construction Activity:	46 days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.09	0.01	0.04	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.03	0.00
Total Project Emissions (tpy)	**0.094**	**0.006**	**0.037**	**0.002**	**0.037**	**0.009**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00056%	0.000003%	0.0002%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	6,000	0.14	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	4,000	0.09	5	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	146.04	8.66	57.78	2.92	8.83	8.57
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	187.68	11.23	73.49	3.75	11.38	11.03

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**187.68**	**11.23**	**73.49**	**3.75**	**11.38**	**11.03**
Total Project Combustion Emissions (tons)	**0.0938**	**0.0056**	**0.0367**	**0.0019**	**0.0057**	**0.0055**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.06	0.03	0.00	0.00
Total	**0.06**	**0.03**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.14 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.14	0.02
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.14	0.07
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.07	0.07
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.07	0.03
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.14	0.05
TOTAL								0.23

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.23
Qty Equipment:	3.00
Grading days/yr:	**0.08**

120 Room Dorm
Project Summary

Includes:

1 100% of Construction New CENTCOM 215,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	215,000	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	40,000	ft^2	
Total Disturbed Area:	171,191	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	2.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	2.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.74	0.75	2.08	0.36	0.34	0.33
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	8.97	0.94
Total Project Emissions (tpy)	**4.742**	**0.752**	**2.085**	**0.363**	**9.308**	**1.264**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0081%	0.00216%	0.03199%	0.000550%	0.0416%	0.0175%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			37.790				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	171,191	3.93	3	(from "GRADING" below)
Paving:	40,000	0.92	5	
Demolition:	0	0.00	0	
Building Construction:	215,000	4.94	230	
Architectural Coating	215,000	4.94	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	124.92	7.73	47.13	2.50	7.64	7.41
Paving	226.84	13.03	92.89	4.54	13.88	13.46
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	763.26	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,484.39	1,503.88	4,169.26	725.23	678.38	658.03

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,484.39**	**1,503.88**	**4,169.26**	**725.23**	**678.38**	**658.03**
Total Project Combustion Emissions (tons)	**4.7422**	**0.7519**	**2.0846**	**0.3626**	**0.3392**	**0.3290**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project 2 months

Area 0.9 acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project 30 months

Area 3.0 acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.77	0.39	0.08	0.04
General Construction Activities	17.17	8.58	0.86	0.43
Total	**17.94**	**8.97**	**0.94**	**0.47**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 3.93 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	3.93	0.49
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	3.93	1.92
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	1.97	1.98
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	1.97	0.81
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	3.93	1.38
TOTAL								6.59

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	6.59
Qty Equipment:	3.00
Grading days/yr:	**2.20**

Construct JCSE Operations Facility
Project Summary

Includes:

1 100% of Construction JCSE Facility 76,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	76,000	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	114,000	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	2.34	0.41	1.03	0.18	0.17	0.16
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.49	0.15
Total Project Emissions (tpy)	**2.343**	**0.411**	**1.031**	**0.181**	**1.660**	**0.312**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0040%	0.00118%	0.01582%	0.000274%	0.0074%	0.0043%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			22.468				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	114,000	2.62	2	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	76,000	1.74	115	
Architectural Coating	76,000	1.74	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	83.28	5.15	31.42	1.67	5.09	4.94
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	4,530.58	359.93	1,998.97	358.38	325.34	315.58
Architectural Coatings	71.48	456.82	31.31	1.43	6.19	6.00
Total Emissions (lbs):	4,685.34	821.91	2,061.69	361.48	336.62	326.52

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**4,685.34**	**821.91**	**2,061.69**	**361.48**	**336.62**	**326.52**
Total Project Combustion Emissions (tons)	**2.3427**	**0.4110**	**1.0308**	**0.1807**	**0.1683**	**0.1633**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency	0.50		EPA 2001; EPA 2006

(assume 50% control efficiency for PM10 and PM2.5 emissions)

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	2.6	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	2.98	1.49	0.15	0.07
Total	**2.98**	**1.49**	**0.15**	**0.07**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 2.62 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	2.62	0.33
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	2.62	1.28
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	1.31	1.32
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	1.31	0.54
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	2.62	0.92
TOTAL								4.39

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 4.39
Qty Equipment: 3.00
Grading days/yr: **1.46**

Demolish Building 89
Project Summary

Includes:

1 100% of Demolition of Building 89 18,216 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	18,216	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	27,324	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.35	0.02	0.14	0.01	0.02	0.02
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.14	0.01
Total Project Emissions (tpy)	**0.353**	**0.021**	**0.139**	**0.007**	**0.164**	**0.035**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0006%	0.00006%	0.00214%	0.000011%	0.0007%	0.0005%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	27,324	0.63	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	18,216	0.42	21	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	665.07	39.42	263.12	13.30	40.21	39.01
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	706.71	42.00	278.82	14.13	42.76	41.47

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**706.71**	**42.00**	**278.82**	**14.13**	**42.76**	**41.47**
Total Project Combustion Emissions (tons)	**0.3534**	**0.0210**	**0.1394**	**0.0071**	**0.0214**	**0.0207**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.6	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.29	0.14	0.01	0.01
Total	**0.29**	**0.14**	**0.01**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.63 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.63	0.08
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.63	0.31
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.31	0.32
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.31	0.13
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.63	0.22
TOTAL								1.05

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1.05
Qty Equipment: 3.00
Grading days/yr: 0.35

Demolish Building 848
Project Summary

Includes:

1 100% of Demolition Building 848 2,400 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	2,400	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	3,600	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.06	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tpy)	**0.065**	**0.004**	**0.025**	**0.001**	**0.023**	**0.006**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00039%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	3,600	0.08	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	2,400	0.06	3	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	87.62	5.19	34.67	1.75	5.30	5.14
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	129.27	7.77	50.38	2.59	7.84	7.61

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**129.27**	**7.77**	**50.38**	**2.59**	**7.84**	**7.61**
Total Project Combustion Emissions (tons)	**0.0646**	**0.0039**	**0.0252**	**0.0013**	**0.0039**	**0.0038**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.04	0.02	0.00	0.00
Total	**0.04**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.08 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.08	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.08	0.04
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.04	0.04
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.04	0.02
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.08	0.03
TOTAL								0.14

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.14
Qty Equipment: 3.00
Grading days/yr: **0.05**

Demolish Building 860
Project Summary

Includes:

1 100% of Demolition Building 860 — 338 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	338	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	507	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.03	0.00	0.01	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.00	0.00
Total Project Emissions (tpy)	**0.027**	**0.002**	**0.010**	**0.001**	**0.004**	**0.002**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0000%	0.00000%	0.00016%	0.000001%	0.0000%	0.0000%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	507	0.01	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	338	0.01	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	12.34	0.73	4.88	0.25	0.75	0.72
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	53.98	3.31	20.59	1.08	3.29	3.19

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**53.98**	**3.31**	**20.59**	**1.08**	**3.29**	**3.19**
Total Project Combustion Emissions (tons)	**0.0270**	**0.0017**	**0.0103**	**0.0005**	**0.0016**	**0.0016**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency	0.50	EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)		

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.01	0.00	0.00	0.00
Total	**0.01**	**0.00**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.01 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.01	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.01	0.01
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.01	0.01
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.01	0.00
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.01	0.00
TOTAL								0.02

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.02
Qty Equipment:	3.00
Grading days/yr:	**0.01**

Demolish Building 861
Project Summary

Includes:

1 100% of Demolition Building 861 64,964 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	64,964	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	97,446	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	1.23	0.07	0.48	0.02	0.07	0.07
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.51	0.05
Total Project Emissions (tpy)	**1.228**	**0.073**	**0.485**	**0.025**	**0.584**	**0.123**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0021%	0.00021%	0.00744%	0.000037%	0.0026%	0.0017%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	97,446	2.24	2	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	64,964	1.49	75	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	83.28	5.15	31.42	1.67	5.09	4.94
Paving	-	-	-	-	-	-
Demolition	2,371.84	140.60	938.35	47.44	143.41	139.11
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	2,455.12	145.75	969.77	49.10	148.50	144.05

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**2,455.12**	**145.75**	**969.77**	**49.10**	**148.50**	**144.05**
Total Project Combustion Emissions (tons)	**1.2276**	**0.0729**	**0.4849**	**0.0246**	**0.0743**	**0.0720**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	2.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	1.02	0.51	0.05	0.03
Total	**1.02**	**0.51**	**0.05**	**0.03**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 2.24 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	2.24	0.28
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	2.24	1.09
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	1.12	1.13
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	1.12	0.46
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	2.24	0.78
TOTAL								3.75

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 3.75
Qty Equipment: 3.00
Grading days/yr: **1.25**

Demolish Building 886
Project Summary

Includes:

1 100% of Demolition Building 886 — 1,845 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	1,845	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	2,768	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.05	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.01	0.00
Total Project Emissions (tpy)	**0.055**	**0.003**	**0.021**	**0.001**	**0.018**	**0.005**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00032%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	2,768	0.06	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	1,845	0.04	2	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	67.36	3.99	26.65	1.35	4.07	3.95
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	109.00	6.57	42.36	2.18	6.62	6.42

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**109.00**	**6.57**	**42.36**	**2.18**	**6.62**	**6.42**
Total Project Combustion Emissions (tons)	**0.0545**	**0.0033**	**0.0212**	**0.0011**	**0.0033**	**0.0032**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency	0.50	EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)		

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.03	0.01	0.00	0.00
Total	**0.03**	**0.01**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.06 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.06	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.06	0.03
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.03	0.03
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.03	0.01
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.06	0.02
TOTAL								0.11

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.11
Qty Equipment: 3.00
Grading days/yr: **0.04**

Demolish Temporary Building DJC2
Project Summary

Includes:

1 100% of Demolition Temporary Building DJC2 9,600 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	9,600	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	14,400	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.20	0.01	0.08	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.08	0.01
Total Project Emissions (tpy)	**0.196**	**0.012**	**0.077**	**0.004**	**0.087**	**0.019**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0003%	0.00003%	0.00118%	0.000006%	0.0004%	0.0003%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	14,400	0.33	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	9,600	0.22	11	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	350.50	20.78	138.66	7.01	21.19	20.56
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	392.14	23.35	154.37	7.84	23.74	23.03

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**392.14**	**23.35**	**154.37**	**7.84**	**23.74**	**23.03**
Total Project Combustion Emissions (tons)	**0.1961**	**0.0117**	**0.0772**	**0.0039**	**0.0119**	**0.0115**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.3	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.15	0.08	0.01	0.00
Total	**0.15**	**0.08**	**0.01**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.33 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.33	0.04
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.33	0.16
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.17	0.17
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.17	0.07
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.33	0.12
TOTAL								0.55

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.55
Qty Equipment: 3.00
Grading days/yr: **0.18**

Construct JCSE Vehicle Paint Facility
Project Summary

Includes:

1 100% of MacDill Gate — 35,100 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	13,500	ft^2	If project includes any demolition, include here
Total Paved Area:	21,600	ft^2	
Total Disturbed Area:	35,100	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	2.4	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.34	0.02	0.13	0.01	0.02	0.02
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.32	0.06
Total Project Emissions (tpy)	**0.335**	**0.020**	**0.133**	**0.007**	**0.341**	**0.077**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0006%	0.00006%	0.00204%	0.000010%	0.0015%	0.0011%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	35,100	0.81	1	(from "GRADING" below)
Paving:	21,600	0.50	3	
Demolition:	13,500	0.31	15	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	136.10	7.82	55.74	2.72	8.33	8.08
Demolition	492.89	29.22	195.00	9.86	29.80	28.91
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	670.63	39.61	266.44	13.41	40.68	39.46

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**670.63**	**39.61**	**266.44**	**13.41**	**40.68**	**39.46**
Total Project Combustion Emissions (tons)	**0.3353**	**0.0198**	**0.1332**	**0.0067**	**0.0203**	**0.0197**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project 2 months

Area 0.5 acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project 2 months

Area 0.3 acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.50	0.25	0.05	0.02
General Construction Activities	0.14	0.07	0.01	0.00
Total	**0.64**	**0.32**	**0.06**	**0.03**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.81 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.81	0.10
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.81	0.39
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.40	0.41
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.40	0.17
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.81	0.28
TOTAL								1.35

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	1.35
Qty Equipment:	3.00
Grading days/yr:	**0.45**

Construct JCSE Vehicle Paint Facility
Project Summary

Includes:

1 100% of JCSE Vehicle Paint Facility 4,500 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	4,500	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	6,750	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	2.32	0.24	1.02	0.18	0.17	0.16
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.09	0.01
Total Project Emissions (tpy)	**2.322**	**0.240**	**1.023**	**0.180**	**0.255**	**0.171**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0040%	0.00069%	0.01570%	0.000274%	0.0011%	0.0024%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			5.467				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	6,750	0.15	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	4,500	0.10	115	
Architectural Coating	4,500	0.10	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total 'Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	4,530.58	359.93	1,998.97	358.38	325.34	315.58
Architectural Coatings	71.48	116.81	31.31	1.43	6.19	6.00
Total Emissions (lbs):	4,643.70	479.31	2,045.98	360.64	334.07	324.05

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**4,643.70**	**479.31**	**2,045.98**	**360.64**	**334.07**	**324.05**
Total Project Combustion Emissions (tons)	**2.3218**	**0.2397**	**1.0230**	**0.1803**	**0.1670**	**0.1620**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.18	0.09	0.01	0.00
Total	**0.18**	**0.09**	**0.01**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.15 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.15	0.02
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.15	0.08
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.08	0.08
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.08	0.03
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.15	0.05
TOTAL								0.26

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.26
Qty Equipment:	3.00
Grading days/yr:	**0.09**

Construct CENTCOM Parking Lot
Project Summary

Includes:

1 100% of Construction CENTCOM Parking Garage 595,981 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	595,981	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	351,571	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.67	1.00	2.05	0.36	0.33	0.32
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	9.20	0.92
Total Project Emissions (tpy)	**4.670**	**0.999**	**2.054**	**0.361**	**9.536**	**1.245**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0080%	0.00286%	0.03151%	0.000548%	0.0426%	0.0172%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			62.918				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	351,571	8.07	5	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	0	0.00	0	
Building Construction:	595,981	13.68	230	
Architectural Coating	595,981	13.68	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	208.21	12.88	78.55	4.16	12.73	12.35
Paving	-	-	-	-	-	-
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	1,265.82	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,340.84	1,998.56	4,107.79	722.35	669.59	649.51

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,340.84**	**1,998.56**	**4,107.79**	**722.35**	**669.59**	**649.51**
Total Project Combustion Emissions (tons)	**4.6704**	**0.9993**	**2.0539**	**0.3612**	**0.3348**	**0.3248**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	8.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	18.40	9.20	0.92	0.46
Total	**18.40**	**9.20**	**0.92**	**0.46**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 8.07 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	8.07	1.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	8.07	3.95
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	4.04	4.07
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	4.04	1.67
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	8.07	2.83
TOTAL								13.52

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	13.52
Qty Equipment:	3.00
Grading days/yr:	**4.51**

Demolish Building 1051
Project Summary

Includes:

1 100% of Demolition Building 1051 11,205 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	11,205	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	16,808	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.23	0.01	0.09	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.09	0.01
Total Project Emissions (tpy)	**0.225**	**0.013**	**0.089**	**0.005**	**0.102**	**0.022**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0004%	0.00004%	0.00136%	0.000007%	0.0005%	0.0003%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	16,808	0.39	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	11,205	0.26	13	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	409.10	24.25	161.85	8.18	24.74	23.99
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	450.74	26.83	177.56	9.01	27.28	26.46

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**450.74**	**26.83**	**177.56**	**9.01**	**27.28**	**26.46**
Total Project Combustion Emissions (tons)	**0.2254**	**0.0134**	**0.0888**	**0.0045**	**0.0136**	**0.0132**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.4	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.18	0.09	0.01	0.00
Total	**0.18**	**0.09**	**0.01**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.39 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.39	0.05
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.39	0.19
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.19	0.19
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.19	0.08
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.39	0.14
TOTAL								0.65

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.65
Qty Equipment:	3.00
Grading days/yr:	**0.22**

Demolish Building 1053
Project Summary

Includes:

1 100% of Demolition Building 1053 — 6,188 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	6,188	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	9,282	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.13	0.01	0.05	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.05	0.00
Total Project Emissions (tpy)	**0.134**	**0.008**	**0.053**	**0.003**	**0.057**	**0.013**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00081%	0.000004%	0.0003%	0.0002%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	9,282	0.21	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	6,188	0.14	7	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	225.92	13.39	89.38	4.52	13.66	13.25
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	267.57	15.97	105.09	5.35	16.21	15.72

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**267.57**	**15.97**	**105.09**	**5.35**	**16.21**	**15.72**
Total Project Combustion Emissions (tons)	**0.1338**	**0.0080**	**0.0525**	**0.0027**	**0.0081**	**0.0079**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.10	0.05	0.00	0.00
Total	**0.10**	**0.05**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.21 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.21	0.03
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.21	0.10
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.11	0.11
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.11	0.04
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.21	0.07
TOTAL								0.36

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.36
Qty Equipment:	3.00
Grading days/yr:	**0.12**

Warehouse Complex
Project Summary

Includes:

1 100% of Construction Warehouse Complex 193,277 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	38,400	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	24,000	ft^2	
Total Disturbed Area:	193,277	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	2.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	4.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.70	0.53	2.07	0.36	0.34	0.33
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	9.32	0.98
Total Project Emissions (tpy)	**4.697**	**0.531**	**2.066**	**0.362**	**9.659**	**1.305**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0081%	0.00152%	0.03170%	0.000549%	0.0432%	0.0181%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			15.971				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	193,277	4.44	3	(from "GRADING" below)
Paving:	24,000	0.55	3	
Demolition:	0	0.00	0	
Building Construction:	38,400	0.88	230	
Architectural Coating	38,400	0.88	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	124.92	7.73	47.13	2.50	7.64	7.41
Paving	136.10	7.82	55.74	2.72	8.33	8.08
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	326.88	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,393.66	1,062.28	4,132.10	723.41	672.83	652.65

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,393.66**	**1,062.28**	**4,132.10**	**723.41**	**672.83**	**652.65**
Total Project Combustion Emissions (tons)	**4.6968**	**0.5311**	**2.0661**	**0.3617**	**0.3364**	**0.3263**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006

Control Efficiency	0.50		EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)			

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	4	months
Area	0.6	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	24	months
Area	3.9	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.93	0.46	0.09	0.05
General Construction Activities	17.72	8.86	0.89	0.44
Total	**18.65**	**9.32**	**0.98**	**0.49**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 4.44 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	4.44	0.55
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	4.44	2.17
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	2.22	2.24
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	2.22	0.92
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	4.44	1.56
TOTAL								7.43

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	7.43
Qty Equipment:	3.00
Grading days/yr:	**2.48**

Logistics Readiness Complex
Project Summary

Includes:

1 100% of Construction Logistics Readiness Complex 224,923 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	73,143	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	179,503	ft^2	
Total Disturbed Area:	224,923	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	4.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	5.08	0.61	2.22	0.37	0.36	0.35
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	4.65	0.81
Total Project Emissions (tpy)	**5.082**	**0.614**	**2.224**	**0.369**	**5.010**	**1.160**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0087%	0.00176%	0.03412%	0.000561%	0.0224%	0.0161%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			22.042				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	224,923	5.16	3	(from "GRADING" below)
Paving:	179,503	4.12	20	
Demolition:	0	0.00	0	
Building Construction:	73,143	1.68	230	
Architectural Coating	73,143	1.68	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	124.92	7.73	47.13	2.50	7.64	7.41
Paving	907.35	52.11	371.57	18.15	55.52	53.86
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	448.30	31.31	1.43	6.19	6.00
Total Emissions (lbs):	10,164.90	1,228.00	4,447.94	738.84	720.02	698.42

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**10,164.90**	**1,228.00**	**4,447.94**	**738.84**	**720.02**	**698.42**
Total Project Combustion Emissions (tons)	**5.0825**	**0.6140**	**2.2240**	**0.3694**	**0.3600**	**0.3492**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
$PM_{2.5}$ Emissions			
$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	4	months
Area	4.1	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	1.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	6.92	3.46	0.69	0.35
General Construction Activities	2.38	1.19	0.12	0.06
Total	**9.30**	**4.65**	**0.81**	**0.41**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 5.16 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	5.16	0.65
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	5.16	2.52
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	2.58	2.60
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	2.58	1.07
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	5.16	1.81
TOTAL								8.65

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 8.65
Qty Equipment: 3.00
Grading days/yr: **2.88**

SOCCENT Headquarters
Project Summary

Includes:

1 100% of Construction SOCCENT HQ 95,022 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	95,022	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	120,600	ft^2	
Total Disturbed Area:	479,160	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	4.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	5.03	0.64	2.20	0.37	0.36	0.35
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	11.71	1.40
Total Project Emissions (tpy)	**5.030**	**0.642**	**2.200**	**0.368**	**12.066**	**1.750**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0086%	0.00184%	0.03375%	0.000559%	0.0539%	0.0242%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			25.123				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	479,160	11.00	7	(from "GRADING" below)
Paving:	120,600	2.77	14	
Demolition:	0	0.00	0	
Building Construction:	95,022	2.18	230	
Architectural Coating	95,022	2.18	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	291.49	18.04	109.97	5.83	17.82	17.28
Paving	635.14	36.48	260.10	12.70	38.87	37.70
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	509.92	31.31	1.43	6.19	6.00
Total Emissions (lbs):	10,059.27	1,284.30	4,399.31	736.72	713.55	692.14

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**10,059.27**	**1,284.30**	**4,399.31**	**736.72**	**713.55**	**692.14**
Total Project Combustion Emissions (tons)	**5.0296**	**0.6421**	**2.1997**	**0.3684**	**0.3568**	**0.3461**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	4	months
Area	2.8	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	8.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	4.65	2.33	0.47	0.23
General Construction Activities	18.77	9.38	0.94	0.47
Total	**23.42**	**11.71**	**1.40**	**0.70**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 11.00 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	11.00	1.38
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	11.00	5.38
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	5.50	5.55
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	5.50	2.28
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	11.00	3.86
TOTAL								18.43

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	18.43
Qty Equipment:	3.00
Grading days/yr:	**6.14**

CATM
Project Summary

Includes:

1 100% of Construction of New CATM 6,964 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	6,964	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	46,500	ft^2	
Total Disturbed Area:	53,464	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	2.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.72	0.44	2.08	0.36	0.34	0.33
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.63	0.11
Total Project Emissions (tpy)	**4.723**	**0.441**	**2.078**	**0.362**	**0.969**	**0.436**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0081%	0.00126%	0.03189%	0.000550%	0.0043%	0.0060%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			6.801				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	53,464	1.23	1	(from "GRADING" below)
Paving:	46,500	1.07	6	
Demolition:	0	0.00	0	
Building Construction:	6,964	0.16	230	
Architectural Coating	6,964	0.16	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	272.20	15.63	111.47	5.44	16.66	16.16
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	143.49	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,446.48	881.56	4,156.42	724.47	676.07	655.79

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,446.48**	**881.56**	**4,156.42**	**724.47**	**676.07**	**655.79**
Total Project Combustion Emissions (tons)	**4.7232**	**0.4408**	**2.0782**	**0.3622**	**0.3380**	**0.3279**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	1.1	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.90	0.45	0.09	0.04
General Construction Activities	0.36	0.18	0.02	0.01
Total	**1.26**	**0.63**	**0.11**	**0.05**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.23 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.23	0.15
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.23	0.60
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.61	0.62
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.61	0.25
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.23	0.43
TOTAL								2.06

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	2.06
Qty Equipment:	3.00
Grading days/yr:	**0.69**

CDC
Project Summary

Includes:

1 100% of Construction CDC 31,110 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	31,110	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	30,000	ft^2	
Total Disturbed Area:	152,460	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	2.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Combustion Emissions (tpy)	4.70	0.52	2.07	0.36	0.34	0.33
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	5.10	0.54
Total Project Emissions (tpy)	**4.699**	**0.515**	**2.067**	**0.362**	**5.433**	**0.865**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0081%	0.00148%	0.03172%	0.000549%	0.0243%	0.0120%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			14.375				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	152,460	3.50	2	(from "GRADING" below)
Paving:	30,000	0.69	4	
Demolition:	0	0.00	0	
Building Construction:	31,110	0.71	230	
Architectural Coating	31,110	0.71	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	83.28	5.15	31.42	1.67	5.09	4.94
Paving	181.47	10.42	74.31	3.63	11.10	10.77
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	294.96	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,397.39	1,030.40	4,134.97	723.49	673.06	652.87

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,397.39**	**1,030.40**	**4,134.97**	**723.49**	**673.06**	**652.87**
Total Project Combustion Emissions (tons)	**4.6987**	**0.5152**	**2.0675**	**0.3617**	**0.3365**	**0.3264**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.7	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	18	months
Area	2.8	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.58	0.29	0.06	0.03
General Construction Activities	9.61	4.81	0.48	0.24
Total	**10.19**	**5.10**	**0.54**	**0.27**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 3.50 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	3.50	0.44
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	3.50	1.71
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	1.75	1.76
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	1.75	0.72
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	3.50	1.23
TOTAL								5.86

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 5.86
Qty Equipment: 3.00
Grading days/yr: **1.95**

120 Room Dorm
Project Summary

Includes:

1 100% of Construction 120 Room Dorm 35,620 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	35,620	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	15,000	ft^2	
Total Disturbed Area:	50,620	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	2.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.63	0.52	2.04	0.36	0.33	0.32
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.54	0.17
Total Project Emissions (tpy)	**4.633**	**0.521**	**2.041**	**0.360**	**1.875**	**0.491**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0080%	0.00149%	0.03132%	0.000547%	0.0084%	0.0068%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			15.382				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	50,620	1.16	1	(from "GRADING" below)
Paving:	15,000	0.34	2	
Demolition:	0	0.00	0	
Building Construction:	35,620	0.82	230	
Architectural Coating	35,620	0.82	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	90.73	5.21	37.16	1.81	5.55	5.39
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	315.10	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,265.01	1,042.74	4,082.11	720.84	664.96	645.02

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,265.01**	**1,042.74**	**4,082.11**	**720.84**	**664.96**	**645.02**
Total Project Combustion Emissions (tons)	**4.6325**	**0.5214**	**2.0411**	**0.3604**	**0.3325**	**0.3225**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.3	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	18	months
Area	0.8	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.29	0.14	0.03	0.01
General Construction Activities	2.80	1.40	0.14	0.07
Total	**3.09**	**1.54**	**0.17**	**0.08**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.16 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.16	0.15
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.16	0.57
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.58	0.59
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.58	0.24
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.16	0.41
TOTAL								1.95

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1.95
Qty Equipment: 3.00
Grading days/yr: **0.65**

Demolition of Building 1066
Project Summary

Includes:

1 100% of Demolition Building 1066 4,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	4,000	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	6,000	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.09	0.01	0.04	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.03	0.00
Total Project Emissions (tpy)	**0.094**	**0.006**	**0.037**	**0.002**	**0.037**	**0.009**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00056%	0.000003%	0.0002%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	6,000	0.14	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	4,000	0.09	5	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	146.04	8.66	57.78	2.92	8.83	8.57
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	187.68	11.23	73.49	3.75	11.38	11.03

Results: Total Project Annual Emission Rates

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Total Project Combustion Emissions (lbs)	**187.68**	**11.23**	**73.49**	**3.75**	**11.38**	**11.03**
Total Project Combustion Emissions (tons)	**0.0938**	**0.0056**	**0.0367**	**0.0019**	**0.0057**	**0.0055**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.06	0.03	0.00	0.00
Total	**0.06**	**0.03**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.14 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.14	0.02
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.14	0.07
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.07	0.07
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.07	0.03
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.14	0.05
TOTAL								0.23

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.23
Qty Equipment: 3.00
Grading days/yr: **0.08**

Demolition of Building 373
Project Summary

Includes:

1 100% of Demolition of Building 373 27,738 ft^2 13869

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	27,738	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	41,607	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.53	0.03	0.21	0.01	0.03	0.03
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.22	0.02
Total Project Emissions (tpy)	**0.527**	**0.031**	**0.208**	**0.011**	**0.250**	**0.053**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0009%	0.00009%	0.00319%	0.000016%	0.0011%	0.0007%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	41,607	0.96	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	27,738	0.64	32	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	1,012.72	60.03	400.65	20.25	61.23	59.40
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	1,054.36	62.61	416.36	21.09	63.78	61.86

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**1,054.36**	**62.61**	**416.36**	**21.09**	**63.78**	**61.86**
Total Project Combustion Emissions (tons)	**0.5272**	**0.0313**	**0.2082**	**0.0105**	**0.0319**	**0.0309**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	1.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.44	0.22	0.02	0.01
Total	**0.44**	**0.22**	**0.02**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.96 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.96	0.12
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.96	0.47
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.48	0.48
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.48	0.20
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.96	0.34
TOTAL								1.60

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	1.60
Qty Equipment:	3.00
Grading days/yr:	**0.53**

JCSE Squadron Facility
Project Summary

Includes:

1 100% of Construction JCSE Squadron Facility 77,344 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	77,344	ft^2	
Total Demolished Area:		ft^2	If project includes any demolition, include here
Total Paved Area:	31,500	ft^2	
Total Disturbed Area:	70,172	ft^2	Construction Projects could disturb more than the paved area. If so, cell "C14" should be changed tc
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	3.0	months	
Annual Construction Activity:	230	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	4.68	0.60	2.06	0.36	0.34	0.33
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.47	0.19
Total Project Emissions (tpy)	**4.678**	**0.597**	**2.060**	**0.361**	**1.803**	**0.518**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0080%	0.00171%	0.03160%	0.000548%	0.0081%	0.0072%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			22.666				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	70,172	1.61	1	(from "GRADING" below)
Paving:	31,500	0.72	4	
Demolition:	0	0.00	0	
Building Construction:	77,344	1.78	230	
Architectural Coating	77,344	1.78	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	181.47	10.42	74.31	3.63	11.10	10.77
Demolition	-	-	-	-	-	-
Building Construction	9,061.15	719.86	3,997.93	716.76	650.68	631.16
Architectural Coatings	71.48	460.78	31.31	1.43	6.19	6.00
Total Emissions (lbs):	9,355.74	1,193.64	4,119.26	722.65	670.52	650.40

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**9,355.74**	**1,193.64**	**4,119.26**	**722.65**	**670.52**	**650.40**
Total Project Combustion Emissions (tons)	**4.6779**	**0.5968**	**2.0596**	**0.3613**	**0.3353**	**0.3252**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project: 3 months

Area: 0.7 acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project: 12 months

Area: 0.9 acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.91	0.46	0.09	0.05
General Construction Activities	2.02	1.01	0.10	0.05
Total	**2.94**	**1.47**	**0.19**	**0.10**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.61 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.61	0.20
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.61	0.79
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.81	0.81
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.81	0.33
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.61	0.56
TOTAL								2.70

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	2.70
Qty Equipment:	3.00
Grading days/yr:	**0.90**

Demolish Building 297
Project Summary

Includes:

1 100% of Demolition Building 297 9,216 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	9,216	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	13,824	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.19	0.01	0.07	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.07	0.01
Total Project Emissions (tpy)	**0.189**	**0.011**	**0.074**	**0.004**	**0.084**	**0.018**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0003%	0.00003%	0.00114%	0.000006%	0.0004%	0.0003%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	13,824	0.32	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	9,216	0.21	11	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	336.48	19.95	133.12	6.73	20.34	19.73
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	378.12	22.52	148.83	7.56	22.89	22.20

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**378.12**	**22.52**	**148.83**	**7.56**	**22.89**	**22.20**
Total Project Combustion Emissions (tons)	**0.1891**	**0.0113**	**0.0744**	**0.0038**	**0.0114**	**0.0111**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency	0.50		EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)			

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.3	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.14	0.07	0.01	0.00
Total	**0.14**	**0.07**	**0.01**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.32 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.32	0.04
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.32	0.16
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.16	0.16
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.16	0.07
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.32	0.11
TOTAL								0.53

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.53
Qty Equipment: 3.00
Grading days/yr: **0.18**

Demolish Buildings 258 and 2020
Project Summary

Includes:

1 100% of Demolition Buildings 258 and 2020 27,320 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	27,320	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	40,980	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.52	0.03	0.21	0.01	0.03	0.03
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.21	0.02
Total Project Emissions (tpy)	**0.520**	**0.031**	**0.205**	**0.010**	**0.246**	**0.052**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0009%	0.00009%	0.00315%	0.000016%	0.0011%	0.0007%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	40,980	0.94	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	27,320	0.63	31	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	997.46	59.13	394.61	19.95	60.31	58.50
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	1,039.10	61.71	410.32	20.78	62.85	60.97

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**1,039.10**	**61.71**	**410.32**	**20.78**	**62.85**	**60.97**
Total Project Combustion Emissions (tons)	**0.5195**	**0.0309**	**0.2052**	**0.0104**	**0.0314**	**0.0305**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency	0.50		EPA 2001; EPA 2006

(assume 50% control efficiency for PM10 and PM2.5 emissions)

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.9	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.43	0.21	0.02	0.01
Total	**0.43**	**0.21**	**0.02**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.94 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.94	0.12
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.94	0.46
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.47	0.47
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.47	0.19
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.94	0.33
TOTAL								1.58

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	1.58
Qty Equipment:	3.00
Grading days/yr:	**0.53**

Demolish Building 500
Project Summary

Includes:

1 100% of Demolition Building 500 — 34,644 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	34,644	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	51,966	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.65	0.04	0.26	0.01	0.04	0.04
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.27	0.03
Total Project Emissions (tpy)	**0.653**	**0.039**	**0.258**	**0.013**	**0.312**	**0.066**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0011%	0.00011%	0.00396%	0.000020%	0.0014%	0.0009%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	51,966	1.19	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	34,644	0.80	40	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	1,264.86	74.98	500.40	25.30	76.48	74.18
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	1,306.50	77.56	516.11	26.13	79.02	76.65

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**1,306.50**	**77.56**	**516.11**	**26.13**	**79.02**	**76.65**
Total Project Combustion Emissions (tons)	**0.6532**	**0.0388**	**0.2581**	**0.0131**	**0.0395**	**0.0383**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	1.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.54	0.27	0.03	0.01
Total	**0.54**	**0.27**	**0.03**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.19 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.19	0.15
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.19	0.58
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.60	0.60
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.60	0.25
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.19	0.42
TOTAL								2.00

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	2.00
Qty Equipment:	3.00
Grading days/yr:	**0.67**

Demolish Building 510
Project Summary

Includes:

1 100% of Demolition Building 510 — 1,250 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	1,250	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	1,875	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.04	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.01	0.00
Total Project Emissions (tpy)	**0.044**	**0.003**	**0.017**	**0.001**	**0.012**	**0.004**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00026%	0.000001%	0.0001%	0.0000%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	1,875	0.04	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	1,250	0.03	1	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	45.64	2.71	18.06	0.91	2.76	2.68
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	87.28	5.28	33.77	1.75	5.30	5.15

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**87.28**	**5.28**	**33.77**	**1.75**	**5.30**	**5.15**
Total Project Combustion Emissions (tons)	**0.0436**	**0.0026**	**0.0169**	**0.0009**	**0.0027**	**0.0026**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.02	0.01	0.00	0.00
Total	**0.02**	**0.01**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.04 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.04	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.04	0.02
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.02	0.02
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.02	0.01
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.04	0.02
TOTAL								0.07

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.07
Qty Equipment:	3.00
Grading days/yr:	**0.02**

Demolish Building 119
Project Summary

Includes:

1 100% of Demolition Building 119 — 1,013 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	1,013	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	1,520	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.04	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.01	0.00
Total Project Emissions (tpy)	**0.039**	**0.002**	**0.015**	**0.001**	**0.010**	**0.003**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00023%	0.000001%	0.0000%	0.0000%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	1,520	0.03	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	1,013	0.02	1	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	36.98	2.19	14.63	0.74	2.24	2.17
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	78.63	4.77	30.34	1.57	4.78	4.64

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**78.63**	**4.77**	**30.34**	**1.57**	**4.78**	**4.64**
Total Project Combustion Emissions (tons)	**0.0393**	**0.0024**	**0.0152**	**0.0008**	**0.0024**	**0.0023**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.02	0.01	0.00	0.00
Total	**0.02**	**0.01**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.03 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.03	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.03	0.02
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.02	0.02
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.02	0.01
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.03	0.01
TOTAL								0.06

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.06
Qty Equipment:	3.00
Grading days/yr:	**0.02**

Demolish Building 317
Project Summary

Includes:

1 100% of Demolition Building 317 3,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	3,000	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	4,500	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.08	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tpy)	**0.076**	**0.005**	**0.030**	**0.002**	**0.028**	**0.007**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00045%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	4,500	0.10	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	3,000	0.07	3	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	109.53	6.49	43.33	2.19	6.62	6.42
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	151.17	9.07	59.04	3.02	9.17	8.89

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**151.17**	**9.07**	**59.04**	**3.02**	**9.17**	**8.89**
Total Project Combustion Emissions (tons)	**0.0756**	**0.0045**	**0.0295**	**0.0015**	**0.0046**	**0.0044**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.05	0.02	0.00	0.00
Total	**0.05**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.10 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.10	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.10	0.05
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.05	0.05
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.05	0.02
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.10	0.04
TOTAL								0.17

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.17
Qty Equipment: 3.00
Grading days/yr: **0.06**

Demolish Building 397
Project Summary

Includes:

1 100% of Demolition Building 397 30,672 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	30,672	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	46,008	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.58	0.03	0.23	0.01	0.04	0.03
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.24	0.02
Total Project Emissions (tpy)	**0.581**	**0.034**	**0.229**	**0.012**	**0.276**	**0.058**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0010%	0.00010%	0.00352%	0.000018%	0.0012%	0.0008%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	46,008	1.06	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	30,672	0.70	35	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	1,119.84	66.38	443.03	22.40	67.71	65.68
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	1,161.48	68.96	458.74	23.23	70.25	68.15

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**1,161.48**	**68.96**	**458.74**	**23.23**	**70.25**	**68.15**
Total Project Combustion Emissions (tons)	**0.5807**	**0.0345**	**0.2294**	**0.0116**	**0.0351**	**0.0341**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency 0.50 EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	1.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.48	0.24	0.02	0.01
Total	**0.48**	**0.24**	**0.02**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 1.06 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.06	0.13
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.06	0.52
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.53	0.53
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.53	0.22
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.06	0.37
TOTAL								1.77

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1.77
Qty Equipment: 3.00
Grading days/yr: 0.59

Demolish Building 398
Project Summary

Includes:

1 100% of Demolition Building 398 — 2,450 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	2,450	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	3,675	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.07	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tpy)	**0.066**	**0.004**	**0.026**	**0.001**	**0.023**	**0.006**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00039%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	3,675	0.08	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	2,450	0.06	3	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	89.45	5.30	35.39	1.79	5.41	5.25
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	131.09	7.88	51.10	2.62	7.95	7.72

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**131.09**	**7.88**	**51.10**	**2.62**	**7.95**	**7.72**
Total Project Combustion Emissions (tons)	**0.0655**	**0.0039**	**0.0255**	**0.0013**	**0.0040**	**0.0039**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.04	0.02	0.00	0.00
Total	**0.04**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.08 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.08	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.08	0.04
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.04	0.04
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.04	0.02
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.08	0.03
TOTAL								0.14

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.14
Qty Equipment:	3.00
Grading days/yr:	**0.05**

Demolish Building 540
Project Summary

Includes:

1 100% of Demolition Building 540 187,215 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	187,215	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	280,823	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	3.50	0.21	1.38	0.07	0.21	0.21
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	3.67	0.37
Total Project Emissions (tpy)	**3.501**	**0.208**	**1.384**	**0.070**	**3.886**	**0.573**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0060%	0.00060%	0.02123%	0.000106%	0.0174%	0.0079%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	280,823	6.45	4	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	187,215	4.30	215	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	166.56	10.31	62.84	3.33	10.18	9.88
Paving	-	-	-	-	-	-
Demolition	6,835.23	405.18	2,704.17	136.70	413.28	400.88
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	7,001.80	415.49	2,767.01	140.04	423.46	410.76

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**7,001.80**	**415.49**	**2,767.01**	**140.04**	**423.46**	**410.76**
Total Project Combustion Emissions (tons)	**3.5009**	**0.2077**	**1.3835**	**0.0700**	**0.2117**	**0.2054**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency	0.50		EPA 2001; EPA 2006

(assume 50% control efficiency for PM10 and PM2.5 emissions)

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	6.4	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	7.35	3.67	0.37	0.18
Total	**7.35**	**3.67**	**0.37**	**0.18**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 6.45 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	6.45	0.81
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	6.45	3.15
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	3.22	3.25
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	3.22	1.33
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	6.45	2.26
TOTAL								10.80

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 10.80
Qty Equipment: 3.00
Grading days/yr: **3.60**

Demolish Building 541
Project Summary

Includes:

1 100% of Demolition Building 541 2,296 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	2,296	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	3,444	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.06	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tpy)	**0.063**	**0.004**	**0.024**	**0.001**	**0.022**	**0.005**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00037%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day) NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	3,444	0.08	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	2,296	0.05	3	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	83.83	4.97	33.16	1.68	5.07	4.92
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	125.47	7.55	48.87	2.51	7.61	7.39

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**125.47**	**7.55**	**48.87**	**2.51**	**7.61**	**7.39**
Total Project Combustion Emissions (tons)	**0.0627**	**0.0038**	**0.0244**	**0.0013**	**0.0038**	**0.0037**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.04	0.02	0.00	0.00
Total	**0.04**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.08 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.08	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.08	0.04
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.04	0.04
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.04	0.02
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.08	0.03
TOTAL								0.13

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.13
Qty Equipment:	3.00
Grading days/yr:	**0.04**

Demolish Building 543
Project Summary

Includes:

1 100% of Demolition Building 543 3,069 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0 ft^2	
Total Demolished Area:	3,069 ft^2	If project includes any demolition, include here
Total Paved Area:	0 ft^2	
Total Disturbed Area:	4,604 ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2 year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0 months	
Annual Construction Activity:	46 days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.08	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tpy)	**0.077**	**0.005**	**0.030**	**0.002**	**0.029**	**0.007**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00046%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	4,604	0.11	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	3,069	0.07	4	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	112.05	6.64	44.33	2.24	6.77	6.57
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	153.69	9.22	60.04	3.07	9.32	9.04

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**153.69**	**9.22**	**60.04**	**3.07**	**9.32**	**9.04**
Total Project Combustion Emissions (tons)	**0.0768**	**0.0046**	**0.0300**	**0.0015**	**0.0047**	**0.0045**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency	0.50	EPA 2001; EPA 2006
(assume 50% control efficiency for PM10 and PM2.5 emissions)		

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.05	0.02	0.00	0.00
Total	**0.05**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.11 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.11	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.11	0.05
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.05	0.05
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.05	0.02
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.11	0.04
TOTAL								0.18

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.18
Qty Equipment:	3.00
Grading days/yr:	**0.06**

Demolish Building 178
Project Summary

Includes:

1 100% of Demolition Building 178 — 1,600 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	1,600	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	2,400	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.05	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.01	0.00
Total Project Emissions (tpy)	**0.050**	**0.003**	**0.019**	**0.001**	**0.016**	**0.004**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00030%	0.000002%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	2,400	0.06	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	1,600	0.04	2	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	58.42	3.46	23.11	1.17	3.53	3.43
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	100.06	6.04	38.82	2.00	6.08	5.90

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**100.06**	**6.04**	**38.82**	**2.00**	**6.08**	**5.90**
Total Project Combustion Emissions (tons)	**0.0500**	**0.0030**	**0.0194**	**0.0010**	**0.0030**	**0.0029**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.03	0.01	0.00	0.00
Total	**0.03**	**0.01**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 0.06 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.06	0.01
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.06	0.03
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.03	0.03
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.03	0.01
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.06	0.02
TOTAL								0.09

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.09
Qty Equipment:	3.00
Grading days/yr:	**0.03**

Demolish Building 3176
Project Summary

Includes:

1 100% of Demolition Building 3176 120 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	120	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	180	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.02	0.00	0.01	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.00	0.00
Total Project Emissions (tpy)	**0.023**	**0.001**	**0.009**	**0.000**	**0.002**	**0.001**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0000%	0.00000%	0.00013%	0.000001%	0.0000%	0.0000%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	180	0.00	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	120	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	4.38	0.26	1.73	0.09	0.26	0.26
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	46.02	2.84	17.44	0.92	2.81	2.73

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**46.02**	**2.84**	**17.44**	**0.92**	**2.81**	**2.73**
Total Project Combustion Emissions (tons)	**0.0230**	**0.0014**	**0.0087**	**0.0005**	**0.0014**	**0.0014**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10	EPA 2001; EPA 2006

Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.00	0.00	0.00	0.00
Total	**0.00**	**0.00**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.00 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.00	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.00	0.00
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.00	0.00
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.00	0.00
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.00	0.00
TOTAL								0.01

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.01
Qty Equipment: 3.00
Grading days/yr: **0.00**

Demolish Building 3500
Project Summary

Includes:

1 100% of Demolition Building 3500 — 120 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	120	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	180	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.2	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	46	days/yr	

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.02	0.00	0.01	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.00	0.00
Total Project Emissions (tpy)	**0.023**	**0.001**	**0.009**	**0.000**	**0.002**	**0.001**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0000%	0.00000%	0.00013%	0.000001%	0.0000%	0.0000%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	180	0.00	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	120	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	4.38	0.26	1.73	0.09	0.26	0.26
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	46.02	2.84	17.44	0.92	2.81	2.73

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**46.02**	**2.84**	**17.44**	**0.92**	**2.81**	**2.73**
Total Project Combustion Emissions (tons)	**0.0230**	**0.0014**	**0.0087**	**0.0005**	**0.0014**	**0.0014**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	2	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.00	0.00	0.00	0.00
Total	**0.00**	**0.00**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.00 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.00	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.00	0.00
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.00	0.00
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.00	0.00
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.00	0.00
TOTAL								0.01

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.01
Qty Equipment: 3.00
Grading days/yr: **0.00**

Eliminate CENTCOM AVENUE
Project Summary

Includes:

1 100% of Eliminate CENTCOM Avenue 6,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	6,000	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	9,000	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	0.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.13	0.01	0.05	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.12	0.01
Total Project Emissions (tpy)	**0.130**	**0.008**	**0.051**	**0.003**	**0.126**	**0.019**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00079%	0.000004%	0.0006%	0.0003%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	9,000	0.21	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	6,000	0.14	7	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	219.06	12.99	86.67	4.38	13.25	12.85
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	260.70	15.56	102.37	5.21	15.79	15.32

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**260.70**	**15.56**	**102.37**	**5.21**	**15.79**	**15.32**
Total Project Combustion Emissions (tons)	**0.1304**	**0.0078**	**0.0512**	**0.0026**	**0.0079**	**0.0077**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	-	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.24	0.12	0.01	0.01
Total	**0.24**	**0.12**	**0.01**	**0.01**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.21 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.21	0.03
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.21	0.10
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.10	0.10
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.10	0.04
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.21	0.07
TOTAL								0.35

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.35

Qty Equipment: 3.00

Grading days/yr: **0.12**

Extend SOCOM Memorial Drive
Project Summary

Includes:

1 100% of Extend SOCOM Memorial Drive 9,600 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	9,600	ft^2
Total Disturbed Area:	19,200	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months
Annual Construction Activity:	115	days/yr

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.07	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.40	0.07
Total Project Emissions (tpy)	**0.066**	**0.004**	**0.026**	**0.001**	**0.407**	**0.072**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00041%	0.000002%	0.0018%	0.0010%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	19,200	0.44	1	(from "GRADING" below)
Paving:	9,600	0.22	2	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	90.73	5.21	37.16	1.81	5.55	5.39
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	132.38	7.79	52.87	2.65	8.10	7.85

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**132.38**	**7.79**	**52.87**	**2.65**	**8.10**	**7.85**
Total Project Combustion Emissions (tons)	**0.0662**	**0.0039**	**0.0264**	**0.0013**	**0.0040**	**0.0039**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.56	0.28	0.06	0.03
General Construction Activities	0.25	0.13	0.01	0.01
Total	**0.81**	**0.40**	**0.07**	**0.03**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.44 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.44	0.06
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.44	0.22
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.22	0.22
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.22	0.09
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.44	0.15
TOTAL								0.74

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.74
Qty Equipment: 3.00
Grading days/yr: **0.25**

Eliminate Intersection - Tampa Point Blvd at Bayshore Blvd
Project Summary

Includes:

1 100% of Eliminate Intersection at Tampa Point Blvd and Bayshore Blvd 1,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	1,000	ft^2	If project includes any demolition, include here
Total Paved Area:	0	ft^2	
Total Disturbed Area:	1,500	ft^2	Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tons)	0.04	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tons)	0.00	0.00	0.00	0.00	0.02	0.00
Total Project Emissions (tons)	**0.039**	**0.002**	**0.015**	**0.001**	**0.022**	**0.004**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00023%	0.000001%	0.0001%	0.0001%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	1,500	0.03	1	(from "GRADING" below)
Paving:	0	0.00	0	
Demolition:	1,000	0.02	1	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	-	-	-	-	-	-
Demolition	36.51	2.16	14.44	0.73	2.21	2.14
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	78.15	4.74	30.15	1.56	4.75	4.61

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**78.15**	**4.74**	**30.15**	**1.56**	**4.75**	**4.61**
Total Project Combustion Emissions (tons)	**0.0391**	**0.0024**	**0.0151**	**0.0008**	**0.0024**	**0.0023**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	-	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.0	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.00	0.00	0.00	0.00
General Construction Activities	0.04	0.02	0.00	0.00
Total	**0.04**	**0.02**	**0.00**	**0.00**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.03 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.03	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.03	0.02
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.02	0.02
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.02	0.01
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.03	0.01
TOTAL								0.06

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.06
Qty Equipment:	3.00
Grading days/yr:	**0.02**

Extend Zemke Ave
Project Summary

Includes:

1 100% of Extend Zemke Avenue 6,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	6,000	ft^2	
Total Disturbed Area:	12,000	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.04	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.25	0.04
Total Project Emissions (tpy)	**0.044**	**0.003**	**0.017**	**0.001**	**0.255**	**0.045**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00026%	0.000001%	0.0011%	0.0006%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	12,000	0.28	1	(from "GRADING" below)
Paving:	6,000	0.14	1	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	45.37	2.61	18.58	0.91	2.78	2.69
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	87.01	5.18	34.29	1.74	5.32	5.16

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**87.01**	**5.18**	**34.29**	**1.74**	**5.32**	**5.16**
Total Project Combustion Emissions (tons)	**0.0435**	**0.0026**	**0.0171**	**0.0009**	**0.0027**	**0.0026**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
$PM_{2.5}$ Emissions			
$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.1	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.1	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.35	0.17	0.03	0.02
General Construction Activities	0.16	0.08	0.01	0.00
Total	**0.50**	**0.25**	**0.04**	**0.02**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.28 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.28	0.03
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.28	0.13
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.14	0.14
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.14	0.06
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.28	0.10
TOTAL								0.46

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.46
Qty Equipment:	3.00
Grading days/yr:	**0.15**

Widen South Boundary Boulevard
Project Summary

Includes:

1 100% of Extend South Boundary Boulevard 8,400 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	8,400	ft^2	
Total Disturbed Area:	16,800	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.04	0.00	0.02	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.35	0.06
Total Project Emissions (tpy)	**0.044**	**0.003**	**0.017**	**0.001**	**0.356**	**0.062**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00026%	0.000001%	0.0016%	0.0009%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	16,800	0.39	1	(from "GRADING" below)
Paving:	8,400	0.19	1	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	45.37	2.61	18.58	0.91	2.78	2.69
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	87.01	5.18	34.29	1.74	5.32	5.16

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**87.01**	**5.18**	**34.29**	**1.74**	**5.32**	**5.16**
Total Project Combustion Emissions (tons)	**0.0435**	**0.0026**	**0.0171**	**0.0009**	**0.0027**	**0.0026**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.2	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	0.49	0.24	0.05	0.02
General Construction Activities	0.22	0.11	0.01	0.01
Total	**0.71**	**0.35**	**0.06**	**0.03**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.39 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.39	0.05
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.39	0.19
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.19	0.19
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.19	0.08
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.39	0.14
TOTAL								0.65

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.65
Qty Equipment: 3.00
Grading days/yr: **0.22**

Extend Great Egret Street
Project Summary

Includes:

1 100% of Extend Great Egret Street 24,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	24,000	ft^2	
Total Disturbed Area:	48,000	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.09	0.01	0.04	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.01	0.17
Total Project Emissions (tpy)	**0.089**	**0.005**	**0.036**	**0.002**	**1.014**	**0.176**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00001%	0.00055%	0.000003%	0.0045%	0.0024%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	48,000	1.10	1	(from "GRADING" below)
Paving:	24,000	0.55	3	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	136.10	7.82	55.74	2.72	8.33	8.08
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	177.74	10.39	71.45	3.55	10.87	10.55

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**177.74**	**10.39**	**71.45**	**3.55**	**10.87**	**10.55**
Total Project Combustion Emissions (tons)	**0.0889**	**0.0052**	**0.0357**	**0.0018**	**0.0054**	**0.0053**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.6	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	6	months
Area	0.6	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	**PM_{10} controlled**	**$PM_{2.5}$ uncontrolled**	**$PM_{2.5}$ controlled**
New Roadway Construction	1.39	0.69	0.14	0.07
General Construction Activities	0.63	0.31	0.03	0.02
Total	**2.02**	**1.01**	**0.17**	**0.09**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters
Construction area: 1.10 acres/yr (from "COMBUSTION" above)
Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.
Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	1.10	0.14
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	1.10	0.54
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.55	0.56
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.55	0.23
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	1.10	0.39
TOTAL								1.85

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1.85
Qty Equipment: 3.00
Grading days/yr: **0.62**

Construct Parking Lot
Project Summary

Includes:

1 100% of Construct Parking Lot 10,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	10,000	ft^2	
Total Disturbed Area:	20,000	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	0.5	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	6.0	months	
Annual Construction Activity:	115	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.07	0.00	0.03	0.00	0.00	0.00
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	0.42	0.07
Total Project Emissions (tpy)	**0.066**	**0.004**	**0.026**	**0.001**	**0.424**	**0.075**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0001%	0.00001%	0.00041%	0.000002%	0.0019%	0.0010%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.
d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.
**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	20,000	0.46	1	(from "GRADING" below)
Paving:	10,000	0.23	2	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	90.73	5.21	37.16	1.81	5.55	5.39
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	132.38	7.79	52.87	2.65	8.10	7.85

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**132.38**	**7.79**	**52.87**	**2.65**	**8.10**	**7.85**
Total Project Combustion Emissions (tons)	**0.0662**	**0.0039**	**0.0264**	**0.0013**	**0.0040**	**0.0039**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project 6 months

Area 0.2 acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project 6 months

Area 0.2 acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	0.58	0.29	0.06	0.03
General Construction Activities	0.26	0.13	0.01	0.01
Total	**0.84**	**0.42**	**0.07**	**0.04**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.46 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.

An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.

200 hp bulldozers are used for site clearing.

300 hp bulldozers are used for stripping, excavation, and backfill.

Vibratory drum rollers are used for compacting.

Stripping, Excavation, Backfill and Compaction require an average of two passes each.

Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.46	0.06
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.46	0.22
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.23	0.23
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.23	0.09
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.46	0.16
TOTAL								0.77

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.77
Qty Equipment:	3.00
Grading days/yr:	**0.26**

Relocate Aircraft Wash Rack
Project Summary

Includes:

1 100% of Relocate Aircraft Wash Rack 10,000 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2
Total Demolished Area:	0	ft^2
Total Paved Area:	36,870	ft^2
Total Disturbed Area:	0	ft^2
Construction Duration:	1.0	year(s)
Paving Duration:	12.0	months
Annual Construction Activity:	230	days/yr

Total Disturbed Area is usually larger than the building being demolished unless the facility demolished is multi-story. If larger, do not use the sum from above, replace with your own value in cell "C14".

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.11	0.01	0.05	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.17	0.33
Total Project Emissions (tpy)	**0.11**	**0.01**	**0.05**	**0.00**	**1.17**	**0.34**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00002%	0.00071%	0.000003%	0.0053%	0.0047%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	0	0.00	0	(from "GRADING" below)
Paving:	36,870	0.85	5	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	-	-	-	-	-	-
Paving	226.84	13.03	92.89	4.54	13.88	13.46
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	226.84	13.03	92.89	4.54	13.88	13.46

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**226.84**	**13.03**	**92.89**	**4.54**	**13.88**	**13.46**
Total Project Combustion Emissions (tons)	**0.1134**	**0.0065**	**0.0464**	**0.0023**	**0.0069**	**0.0067**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	0.8	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	(0.8)	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	4.27	2.13	0.43	0.21
General Construction Activities	-1.93	-0.96	-0.10	-0.05
Total	**2.34**	**1.17**	**0.33**	**0.17**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.00 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.00	0.00
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.00	0.00
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.00	0.00
2315 120 5220	Backfill	Structural, common earth, 150' l	1,950	cu. yd/day	2.42	0.41	0.00	0.00
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.00	0.00
TOTAL								0.00

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 0.00
Qty Equipment: 3.00
Grading days/yr: **0.00**

Other Potential Roadway Improvements
Project Summary

Includes:

1 100% of Other Potential Roadway Improvements 26,800 ft^2

Assumptions:
All land disturbance/grading area includes building construction, utility installation, landscaping, and paving operations.

Total Building Construction Area:	0	ft^2	
Total Demolished Area:	0	ft^2	If project includes any demolition, include here
Total Paved Area:	26,800	ft^2	
Total Disturbed Area:	13,400	ft^2	Roadway Improvement Projects could disturb more than the paved area. If so, cell "C14" should be (
Construction Duration:	1.0	year(s)	If construction duration is less than a year, change the value.
Paving Duration:	12.0	months	
Annual Construction Activity:	230	days/yr	

Project Proposed for CY 2011

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Combustion Emissions (tpy)	0.09	0.01	0.04	0.00	0.01	0.01
Fugitive Dust Emissions (tpy)	0.00	0.00	0.00	0.00	1.20	0.28
Total Project Emissions (tpy)	**0.089**	**0.005**	**0.036**	**0.002**	**1.205**	**0.280**
Hillsborough County Emissions (tpy)	58,191	34,880	6,517	65,890	22,379	7,221
Project Percentage (%)	0.0002%	0.00001%	0.00055%	0.000003%	0.0054%	0.0039%
Regionally Significant? (more than 10%)	**no**	**no**	**no**	**no**	**no**	**no**

Combustion Emissions

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47

Paving

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69

Demolition

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87

Building Construction

Equipment[d]	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Stationary							
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22
Mobile (non-road)							
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74

Note: Footnotes for tables are on following page

Architectural Coatings

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c]	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30
Total per 10 acres of activity	1	3.57	0.37	1.57	0.07	0.31	0.30

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.

b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.

c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.

d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)					
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$
Grading Equipment	1	41.641	2.577	15.710	0.833	2.546	2.469
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.071	0.309	0.300
Architectural Coating**			0.000				

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	13,400	0.31	1	(from "GRADING" below)
Paving:	26,800	0.62	3	
Demolition:	0	0.00	0	
Building Construction:	0	0.00	0	
Architectural Coating	0	0.00	0	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative.
The 'Total 'Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition.
The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Grading Equipment	41.64	2.58	15.71	0.83	2.55	2.47
Paving	136.10	7.82	55.74	2.72	8.33	8.08
Demolition	-	-	-	-	-	-
Building Construction	-	-	-	-	-	-
Architectural Coatings	-	-	-	-	-	-
Total Emissions (lbs):	177.74	10.39	71.45	3.55	10.87	10.55

Results: Total Project Annual Emission Rates

	NO_x	**VOC**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Total Project Combustion Emissions (lbs)	**177.74**	**10.39**	**71.45**	**3.55**	**10.87**	**10.55**
Total Project Combustion Emissions (tons)	**0.0889**	**0.0052**	**0.0357**	**0.0018**	**0.0054**	**0.0053**

Construction Fugitive Dust Emissions

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM_{10}/acre-month	MRI 1996; EPA 2001; EPA 2006

$PM_{2.5}$ Emissions

$PM_{2.5}$ Multiplier (10% of PM10 emissions assumed to be PM2.5)	0.10		EPA 2001; EPA 2006
Control Efficiency (assume 50% control efficiency for PM10 and PM2.5 emissions)	0.50		EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	0.6	acres

General Construction Activities (0.19 ton PM_{10}/acre-month)

Duration of Construction Project	12	months
Area	(0.3)	acres

	Project Emissions (tons/year)			
	PM_{10} uncontrolled	PM_{10} controlled	$PM_{2.5}$ uncontrolled	$PM_{2.5}$ controlled
New Roadway Construction	3.10	1.55	0.31	0.16
General Construction Activities	-0.70	-0.35	-0.04	-0.02
Total	**2.40**	**1.20**	**0.28**	**0.14**

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM_{10}/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM_{10}/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM_{10}/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM_{10}/acre-month) and 75% of the average emission factor (0.11 ton PM_{10}/acre-month). The 0.19 ton PM_{10}/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM_{10}/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM_{10}/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM_{10}/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM10/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

$PM_{2.5}$ Multiplier **0.10**

$PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM_{10} and $PM_{2.5}$ **0.50**

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM_{10} and $PM_{2.5}$ in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999.* EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants.* Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1).* Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Construction (Grading) Schedule

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 0.31 acres/yr (from "COMBUSTION" above)

Qty Equipment: **3.00** (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	0.31	0.04
2230 500 0300	Stripping	Topsoil & stockpiling, adverse s	1,650	cu. yd/day	2.05	0.49	0.31	0.15
2315 432 5220	Excavation	Bulk, open site, common earth,	800	cu. yd/day	0.99	1.01	0.15	0.16
2315 120 5220	Backfill	Structural, common earth, 150'	1,950	cu. yd/day	2.42	0.41	0.15	0.06
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passe	2,300	cu. yd/day	2.85	0.35	0.31	0.11
TOTAL								0.52

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr:	0.52
Qty Equipment:	3.00
Grading days/yr:	**0.17**

* US EPA - AirData Emissions by Category Report - Criteria Air Pollutants, http://www.epa.gov/air/data/geosel.html
* Monday, 13-Jul-2009 at 1:59:26 PM (USA Eastern time zone)
* Geographic Area: Hillsborough Co, FL
* Pollutant: Carbon Monoxide, Nitrogen Oxides, Particles < 10 micrometers diameter, Particles < 2.5 micrometers diameter, Sulfur Dioxide, Volatile Organic Compounds
* Year: 2002
*
* Pollutant Emissions In Tons Per Year
*

			Point Source Emissions						Nonpoint+Mobile Source Emissions					
State	**County**	**Tier I**	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**	**CO**	**NOx**	**PM10**	**PM2.5**	**SO2**	**VOC**
FL	Hillsborough Co	01-Fuel Comb. Elec. Util.	1727	55765	6349	4918	64629	190	0	0	0	0	0	0
FL	Hillsborough Co	02-Fuel Comb. Industrial	150	296	18.1	14.2	15.4	13.6	467	984	9.46	6.39	72.4	29.3
FL	Hillsborough Co	03-Fuel Comb. Other	18.6	59	4.66	4.29	3.54	4.67	1846	788	304	289	501	696
FL	Hillsborough Co	04-Chemical & Allied Product Mfg	0	185	183	58.8	0	2.81	0	0	0	0	0	407
FL	Hillsborough Co	05-Metals Processing	790	1.44	45.4	15.4	577	33.6	0	0	0	0	0	0
FL	Hillsborough Co	06-Petroleum & Related Industries	72.6	19.5	35.5	20.3	20.5	26.3	0	0	0	0	0	0
FL	Hillsborough Co	07-Other Industrial Processes	74.6	17.6	368	136	46.8	131	129	0	544	371	0	347
FL	Hillsborough Co	08-Solvent Utilization	0.28	1.11	16.3	5.93	0	646	0	0	0	0	0	20032
FL	Hillsborough Co	09-Storage & Transport	42.1	13.9	387	125	0.44	493	0	0	0	0	0	11391
FL	Hillsborough Co	10-Waste Disposal & Recycling	23.8	31.4	27.3	19.8	1.01	12.4	48.5	14.6	13	9.23	9.18	174
FL	Hillsborough Co	14-Miscellaneous	0	0	0	0	0	0	1128	14.1	14074	1228	13.3	250
FL	Hillsborough Co	11-Highway Vehicles	0	0	0	0	0	0	228413	25546	706	506	1283	22321
FL	Hillsborough Co	12-Off-Highway	0	0	0	0	0	0	94881	21593	1291	1243	2597	8341
		TOTAL	2,899	56,390	7,434	5,318	65,294	1,553	326,913	48,940	16,941	3,653	4,476	63,988

Criteria Air Pollutant	**CO (tpy)**	**NO_x (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**	**SO2 (tpy)**	**VOC (tpy)**	**Pb (tpy)**
Point Sources	2,899	56,390	7,434	5,318	65,294	1,553	-
Area Sources	3,619	1,801	14,944	1,904	596	33,326	-
Stationary Total	**6,517**	**58,191**	**22,379**	**7,221**	**65,890**	**34,880**	
On-road Mobile	228,413	25,546	706	506	1,283	22,321	-
Non-road Mobile	94,881	21,593	1,291	1,243	2,597	8,341	-
Mobile Total	**323,294**	**47,139**	**1,997**	**1,749**	**3,880**	**30,662**	
Grand Total	**329,811**	**105,330**	**24,376**	**8,970**	**69,770**	**65,542**	**4.46**

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